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National Interlaboratory Quality Control Study No. 35

Trace Metals in Sediments

V. Cheam, A.S.Y. Chau and W. Horn

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Abstract

This report describes an interlaboratory study for the analysis of ten heavy metals in five different sediment reference materials. Over 40 Canadian laboratories participated in the study. The "total" content, as expected, was greater than the "extractable" content for each of the metals studied (Al, Cd, Co, Cu, Fe, Mn, Ni, Pb, V, and Zn). The ratio of "total" to "extractable" varied from metal to metal and ranged from 3.5 for Al to 1.02 for Cu.

Résumé

Ce rapport décrit une étude interlaboratoire pour l'analyse de dix métaux lourds dans cinq différentes substances sédimentaires de référence. Plus de 40 laboratoires canadiens ont participé à l'étude. La teneur «totale», comme on pouvait le prévoir, était supérieure à la teneur «extractible» pour chacun des métaux étudiés (Al, Cd, Co, Cu, Fe, Mn, Ni, Pb, V et Zn). Le rapport de «total» à «extractible» variait selon le métal, étant compris entre 3.5 pour Al et 1.02 pour Cu.

List of Symbols

n	Number of results used
l	Number of laboratories reporting data
$\bar{x}$	Mean value, $\bar{x} = \Sigma x_i/n$
S	Standard deviation, $S = \left(\frac{\sum_{i=1}^{n} (x_i-\bar{x})^2}{n-1}\right)^{1/2}$
H	Result with a flag H was assessed to be high
VH	Result with a flag VH was assessed to be very high
L	Result with a flag L was assessed to be low
VL	Result with a flag VL was assessed to be very low
T	Total
E	Extractable

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INTRODUCTION

This intercomparison study forms part of the continuing National Interlaboratory Quality Control Program of the Quality Assurance Project at the National Water Research Institute (NWRI). As in other national studies, it serves to assess the methodology and data of the laboratories of the Water Quality Branch and the National Water Quality Laboratory by comparison with peer laboratories, and to establish laboratory performance of federal, provincial, university, and private laboratories.

The study covered ten heavy metals, including several priority pollutants such as Cd, Cu, Pb, Ni, and Zn.[1] Each participating laboratory analyzed five sediment samples for these metals and had its methods and data assessed against those of some 40 other laboratories.

STUDY DESIGN

The study used five test samples of naturally contaminated sediment reference materials (RM) (Table 1). Each laboratory chose its own analytical method, but was encouraged to use more than one method.

Table 1. Description of Samples

Test samples	RM	Origin
1	WQB-1	Lake Ontario
2	WQB-3	Lake Ontario-Hamilton Harbour Mixture
3	TH-1	Toronto Harbour
4	HR-1	Humber River
5	SD-1	Sudbury

EXPERIMENTAL

Sample Preparation

Test bottles used were of wide-mouth amber glass with a capacity of 50 mL. They were soaked in 2% HNO_3 overnight, rinsed with deionized distilled water, and oven-dried before use. The sediments were dried and homogenized following the procedures described by Cheam and Chau.[2]

Forty-nine laboratories received 3-g sediment samples, whereas two laboratories requested and received 10-g samples.

Analyses

Table 2 lists the various methodologies and the number of laboratories using each of them. Several participants used more than one analytical method for determination of each metal.

Table 2. Methodologies Used

Methodology	No. of labs
Atomic absorption spectrometry with flame (AAS)	40
Atomic absorption with graphite furnace atomizer (AA Graphite)	5
Inductively coupled plasma (ICP)	16
Instrumental neutron activation analysis (INAA)	4
Direct current plasma (DCP)	2
Inductively coupled plasma/mass spectrometry (ICP/MS)	1
Other	3

DATA EVALUATION

The median value for each sample was determined using all data (except the "less than" values) reported by the participants. The mean and standard deviation were calculated without data rejection (Appendix A, Tables A-1 to A-20). The results of each sample from all the laboratories were ranked according to Youden.[3] All the results were evaluated using the flagging technique[4] as applied in our other quality assurance (QA) programs for the Long Range Transport of Airborne Pollutants (LRTAP) and the International Joint Commission (IJC). By this technique,

the results are classified into five categories, namely unflagged, L (low), VL (very low), H (high), and VH (very high), based on comparison with the medians. Since medians are often good estimates of the true values in unknown samples, the flagging technique provides some evaluation of each result based on median values. Thus, the most accurate results are those that are not flagged, whereas the VH or VL results are farther away from the medians and are interpreted as less accurate.

The ranking procedure[3,4] also assesses simultaneously the pooled "total" and "extractable" results from all five samples to determine laboratories with pronounced systematic errors. The criteria for preparing statements of laboratory appraisals[3,4,5] routinely used in LRTAP and IJC programs have been applied to this study. The optimal values for the Lower Limit for Use of Basic Acceptable Error (LLBAE), the Basic Acceptable Error (BAE), and the Concentration Error Increment (CEI) used in the ranking process are shown in Table 3 for both "total" and "extractable" metals.

Table 3. Optimal Values Used in Ranking Process

Metals	LLBAE	BAE	CEI
Al	2.00	0.60	0.10
Cd	2.00	1.20	0.10
Co	10.00	7.50	0.10
Cu	70.00	7.00	0.10
Fe	2.00	0.25*	0.10
Mn	500.00	50.00	0.10
Ni	40.00	10.00	0.10
Pb	50.00	15.00	0.10
V	30.00	12.00	0.10
Zn	400.00	30.00	0.10

*"Total" Fe; 0.5 for "extractable" Fe.

RESULTS AND DISCUSSION

Sample Pretreatment

The procedures for digesting sediments were so varied that there were almost as many procedures as participants. The tabulation of procedures with their associated chemicals, however, reveals that the most often used procedure for "total" metals was the HNO_3-$HClO_4$-HF digestion with some HCl and H_3BO_3. For "extractable" metals, aqua regia was the most often used digestion procedure. Table 4 lists the various procedures and the number of laboratories using each of them.

The neutron activation technique, which was used by four laboratories for analysis of "total" metals, needs no sample pretreatment. The "total" content by this technique is grouped with that by wet chemical techniques, which usually entail complete destruction of the sediment matrix including the silica lattice. The "extractable" dissolution procedures usually extract the more readily available metals without destruction of the silica lattice.

Table 4. Sample Pretreatment Procedures

"Total" metal pretreatment procedures	No. of labs
HNO_3-$HClO_4$-HF	8
HNO_3-$HClO_4$-HF-HCl	6
HNO_3-$HClO_4$-HG-H_3BO_3	1
Aqua regia-HF-H_3BO_3	3
Aqua regia-HF	3
Aqua regia-HF-H_2O_2	1
Aqua regia (for "total")	3
HNO_3-$HClO_4$-HCl	2
HNO_3-HCl	2
HNO_3-HF	2
HF-$HClO_4$-HCl	1
Ash overnight-HNO_3-HCl	1
Metaborate fusion and pyrosulphate fusion	2

"Extractable" metal pretreatment procedure	No. of labs
Aqua regia	7
HNO_3-$HClO_4$	2
0.5 N HCl	2
HNO_3	2
HCl-HNO_3-H_2O_2	1
HNO_3-H_2O_2	1
HNO_3-HCl-Microwave	1

Analytical and Ranking Data

All raw, flagged, and ranked data for individual samples are tabulated in Appendix A, Tables A-1 to A-20, along with the medians, means, and standard deviations. The overall ranking results for pooled "total" and pooled "extractable" data are given in Appendix B, Tables B-1 to B-10.

Aluminum

The median values from each methodology are compared with the medians from pooled data for both "total" and "extractable" aluminum in Appendix C, Table C-1. Calculations indicate that the individual medians are within 10% of the pooled medians and therefore are, as operationally defined, compatible.

Besides methodology comparison, Table C-1 also compares "total" to "extractable" Al and shows significant disparity between the two, the "total" being more than three times the "extractable." In fact, the exact ratio of the pooled "total" median to the pooled "extractable" median

for each of the five samples ranges from 3.2 to 3.7, giving an average of 3.5. This means that 71% of "total" Al content is well-embedded in the silica lattice as 29% of it is easily extracted by the "extractable" dissolution procedures.

Table 5 summarizes the overall ranking results, listing the laboratories with the fewest systematic errors (column 3) and laboratories with biased results (columns 4 and 5) for all "total" metals studied. Laboratories with the fewest systematic errors for Al were laboratories 130, 111, 58, 120, 102, and 136.

Table 6 summarizes the overall ranking results for "extractable" metals. Laboratories 19C, 30D, 13, and 67 were identified as having the fewest systematic errors for Al.

Cadmium

Of all the metals studied, cadmium is the only element that has the number of results used smaller than the number of laboratories reporting Cd data for each methodology (Appendix C, Table C-2). This is due to a combination of high detection limit and low levels of Cd in the sediments studied. Thus a small degree of compatibility is expected.

The DCP "extractable" results by laboratory 47 are obviously biased high (Table C-2). The overall Cd ranking results are summarized in Tables 5 and 6.

Cobalt

Appendix C, Table C-3, summarizes the median results and shows that there is very little difference between the two types of cobalt. In fact, the ratio of the pooled "total" median to the pooled "extractable" median ranges only from 1.01 to 1.06, with an average of 1.04; that is, 96% of Co can be easily extracted.

The AA "total" data are consistently higher than the pooled medians in all five samples (Table C-3). The Co ranking results are summarized in Tables 5 and 6.

Copper

As in cobalt, the difference between the two species of copper is small; the ratio of the pooled "total" median to the pooled "extractable" median ranges from 1.00 to 1.04, with an average of only 1.02. This corresponds to 98% extraction efficiency of the "extractable" dissolution procedures.

The methodologies are compatible for both species. Note, however, that the INAA has a high detection limit and DCP results fluctuate more than the others (Appendix C, Table C-4). Many laboratories are identified as having few systematic errors (Tables 5 and 6).

Iron

Appendix C, Table C-5, shows that there is a significant difference between the two types of iron. The pooled "total" medians are higher than the pooled "extractable" medians, giving an average ratio of 1.26, which corresponds to about 20% of Fe embedded in the silica lattice.

All methodologies except DCP are compatible. The DCP "extractable" results are consistently higher than the pooled medians by more than 10%. The Fe ranking results are summarized in Tables 5 and 6.

Manganese

The pooled "total" medians for manganese are consistently higher than the pooled "extractable" medians by an average ratio of 1.16, which corresponds to 86% of "extractable" Mn. All methodologies are compatible, and the ranking results are summarized in Tables 5 and 6.

A point of interest should be noted. Laboratory 57 attempted fusion at different temperatures and found potential loss of Mn at elevated temperatures. In sample 1, for example, they found 1420 ppm Mn at 800°C as opposed to 1320 ppm Mn at 650°C. The latter result is indeed very close to the pooled "total" median (Appendix C, Table C-6).

Nickel

Appendix C, Table C-7, shows that the individual "total" medians for nickel are compatible, but the DCP "extractable" results are high. The ratio of pooled medians ranges from 1.03 to 1.17, with an average of 1.10 for the five samples; 91% of Ni is in "extractable" form. The ranking results for both species of Ni are summarized in Tables 5 and 6.

Lead

The ratio of pooled "total" medians to pooled "extractable" medians for lead for each of the five samples ranges from 1.02 to 1.14 (Appendix C, Table C-8), with an average of 1.07 or 93% in "extractable" form. The DCP "extractable" data are again high, whereas the other methodologies are compatible. The Pb ranking results are summarized in Tables 5 and 6.

Table 5. Summary of Overall Ranking Results for Pooled "Total" Metals in Five Samples

Metal	Rank range (Rank average)	Labs within 20% of rank average	Labs with biased high results	Labs with biased low results
Al	1.2 - 32 (16.5)	130, 111, 58, 120, 102, 136	30B, 74	53, 12, 8, 51
Cd	3.0 - 23.9 (13.56)	57, 93, 74B, 62, 73, 19, 24	6	120B
Co	2.0 - 31.2 (16.21)	136, 102, 30, 51, 137, 58, 19, 24, 19B	11B, 53, 65	120B, 12
Cu	1.6 - 33.6 (17.60)	30, 57, 8, 62, 6, 109B, 57B, 23, 74, 19, 58, 111	30B	53, 12, 74B
Fe	1.2 - 34.6 (18.5)	111, 109, 23, 30, 109B, 6, 62, 3, 137	19B, 58, 24	12, 8
Mn	2.0 - 33.2 (17.5)	57B, 51, 8, 23, 111, 109B 19, 30, 58, 76, 109, 19B, 53	136, 137	12
Ni	2.4 - 30.4 (16.92)	76, 51, 19B, 73, 30, 10, 58C, 120, 89, 60, 57B	111B, 6	15, 53, 12
Pb	3.4 - 32.0 (16.5)	73, 74, 109, 57B, 51B, 102 30B, 60B, 109B	65, 111B	12, 23, 10C
V	1.6 - 20.6 (11.5)	65, 136, 137, 10, 57B	15, 23, 19	12, 51
Zn	4 - 36.6 (19.5)	109, 60, 137, 62, 19B, 41, 120B, 102, 30B	136, 15	65, 19, 93

Table 6. Summary of Overall Ranking Results for Pooled "Extractable" Metals in Five Samples

Metal	Rank range (Rank average)	Labs within 20% of rank average	Labs with biased high results	Labs with biased low results
Al	1.0 - 12.8 (7.0)	19C, 30D, 13, 67	119, 34	2, 58B
Cd	2.1 - 14.6 (7.81)	30D, 13, 19C, 58B	47, 10D	71
Co	1.0 - 13.8 (7.5)	19C, 13, 19D, 30C	5	58B
Cu	1.2 - 17.0 (9.0)	30D, 19C, 119, 5, 67, 10D, 34	13	58B, 93B, 2
Fe	1.6 - 15.5 (9.0)	67, 19C, 13, 5, 21	30D	2, 58B, 93B
Mn	1.2 - 14.5 (8.5)	5, 21	130C	58B, 71
Ni	1.0 - 15.1 (8.5)	19D, 21	119, 130C	58B, 2
Pb	1.0 - 15.5 (8.5)	34, 21, 30D	47, 119	58B
V	1.0 - 9.4 (5.5)	67, 10B, 19D, 13	30C, 119	58B, 5
Zn	2.0 - 18.0 (9.5)	19C, 19D, 71, 21	119	2, 93B

Vanadium

The number of analytical results and laboratories reporting vanadium data are fewer than for other metals (Appendix C, Table C-9). The pooled medians indicate that the "total" content exceeds the "extractable" content by about 100%. In fact, the average ratio for the five samples is exactly 2.00. This ratio may not be very reliable, however, as the degree of methodology compatibility is small. For example, the AA "total" medians are high relative to the pooled medians, whereas the "extractable" medians by AA and ICP differ greatly from each other.

Zinc

Appendix C, Table C-10, shows that "total" and "extractable" medians for zinc are very similar, the average ratio of the pooled medians being only 1.03. This seems to suggest that Zn, as with Co, Cu, and Pb, is not well embedded in the silica lattice, and therefore is more easily extracted than Al, Fe, Mn, and perhaps V.

The results from the various methodologies compare well with each other, although the INAA median in sample 1 and the DCP medians in samples 1 and 4 are high. The Zn ranking results are summarized in Tables 5 and 6.

CONCLUSION

This study helped each laboratory to assess its methods and data against many other laboratories in the analysis of heavy metals in sediments. Methods validation and data verification are essential components of any credible quality assurance program.

Although a few laboratories tended to have consistent biased results, many participants reported compatible heavy metals data. Appendix D summarizes the laboratory appraisals based on pooled data.

The average ratio of pooled "total" medians to pooled "extractable" medians over the five samples studied ranged from 1.02 to 3.5 and could be grouped as follows: metals with low ratio of 1.02 to 1.07 (Cu, Co, Zn, and Pb); metals with a medium ratio of 1.10 to 1.26 (Ni, Mn, Cd, and Fe); and metals with a high ratio of 2.0 to 3.5 (V and Al).

ACKNOWLEDGMENTS

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Appendix A

Tables for Raw, Flagged, and Ranked Data for Individual Samples

Table A-1. Total Aluminum (pooled data)

SAMPLE	1			2			3			4			5		
LAB NO	REPORTED VALUE		RANK	REPORTED VALUE		RANK	REPORTED VALUE		RANK	REPORTED VALUE		RANK	REPORTED VALUE		RANK
N004	8.90		26.50	6.10		26.50	6.60		29.00	6.30		24.50	6.70		28.00
N008	2.63	VL	3.00	1.60	VL	3.00	1.94	VL	3.00	1.73	VL	3.00	2.70	VL	6.00
N010	7.39		10.00	3.89	VL	8.00	3.35	VL	6.00	4.79	L	9.00	4.93	L	9.00
N012	1.75	VL	1.00	1.17	VL	2.00	1.40	VL	2.00	1.08	VL	2.00	1.11	VL	2.00
N015	5.78	VL	7.00	3.28	VL	6.00	3.42	VL	7.00	3.58	VL	7.00	3.45	VL	7.00
N019	7.61		12.00	5.51		17.00	5.51		10.00	5.64		13.50	5.94		13.00
N019B	8.81		25.00	6.14		28.00	6.34		27.00	6.63		31.00	6.93		30.00
N023	5.40	VL	9.00	5.20		10.00	5.60		11.00	5.60		12.00	5.80		10 50
N030	8.60		22.50	6.00		23.00	6.20		20.00	6.20		20.00	6.20		15 50
N030B	9.79	H	32.00	6.72		32.00	7.09	H	32.00	6.81		32.00	7.12		32.00
N051	3.42	VL	4.00	2.04	VL	4.00	2.37	VL	4.00	1.86	VL	4.00	1.85	VL	3.00
N053	1.85	VL	2.00	.40	VL	1.00	.38	VL	1.00	.37	VL	1.00	1.07	VL	1.00
N057	8.38		19.00	6.00		23.00	6.40		24.00	6.16		18.00	6.40		19.00
N057B	8.56		21.00	6.02		25.00	6.33		22.00	6.26		22.00	6.52		25.00
N058	8.06		14.00	5.77		14.00	6.08		17.00	6.10		17.00	6.23		17.00
N062	9.71	H	31.00	6.10		26.50	6.60		29.00	6.29		23.00	6.47		21.00
N065	4.20	VL	5.00	4.40	L	9.00	5.50		9.00	5.00		10.00	3.70	VL	8.00
N073	5.98	VL	8.00	3.34	VL	7.00	3.66	VL	8.00	3.25	VL	6.00	2.55	VL	5 00
N074	9.58	H	30.00	6.30		30.00	6.60		29.00	6.60		30.00	7.00		31.00
N074B	8.90		26.50	6.00		23.00	6.00		16.00	6.30		24.50	6.50		23.00
N076	8.78		24.00	5.97		19.00	6.37		23.00	6.22		20.00	6.66		27.00
N102	8.60		22.50	5.80		18.50	6.80		12.00	6.26		20.00	6.20		15.50
N109	9.07		29.00	5.99		21.00	6.46		25.00	6.35		26.00	6.51		24.00
N109B	8.44		20.00	6.21		29.00	6.76		31.00	6.59		28.50	6.43		20.00
N111	7.52		11.00	5.78		15.00	6.11		18.00	5.78		15.50	5.96		14.00
N111B	8.98		28.00	6.48		31.00	6.48		26.00	6.59		29.50	6.82		29.00
N120	8.28		16.00	5.85		18.00	6.89		13.00	4.16	VL	8.00	6.54		26.00
N120B	5.15	VL	6.00	2.63	VL	5.00	2.93	VL	5.00	2.08	VL	5.00	2.29	VL	4.00
N130	8.30		17.00	5.60		13.00	5.92		15.00	5.64		13.50	5.80		10 50
N130B	7.91		13.00	5.56		12.00	5.88		14.00	5.58		11.00	5.91		12.00
N136	8.13		15.00	5.80		16.50	6.16		19.00	5.78		15.50	6.48		22.00
N137	8.33		18.00	5.98		20.00	6.27		21.00	6.39		27.00	6.39		18 00
MEDIAN CONC.	8.298			5.800			6.040			5.940			6.215		
$\bar{X}$	7.31			5.00			5.27			5.12			5.35		
S	2.28			1.71			1.78			1.84			1.87		
n	32			32			32			32			32		
l	32			32			32			32			32		

Table A-2. Extractable Aluminum (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N002	.120 VL	1.00	.066 VL	1.00	.033 VL	1.00	.056 VL	1.00	.089 VL	1.00
N005	2.35	4.00	1.32	3.00	1.73	4.00	1.20	3.00	1.44	4.00
N010A	1.94	3.00	1.43	4.00	1.95	3.00	1.69	10.00	1.42	3.00
N013	2.57	6.00	1.63	8.00	2.20	9.50	1.65	8.00	1.80	8.50
N019C	2.71	8.00	1.57	6.00	1.82	5.00	1.23	4.00	1.58	5.00
N019D	3.56 H	11.00	1.83	10.00	2.29	11.00	1.68	9.00	1.41	10.00
N030C	3.13	10.00	1.85	11.00	2.20	9.50	1.78	12.00	1.93	11.00
N030D	2.61	7.00	1.61	7.00	1.90	7.00	1.57	6.00	1.74	7.00
N034	5.80 VH	13.00	2.66 VH	12.00	2.93 VH	12.00	2.50 H	12.00	2.47 H	12.00
N058B	.146 VL	2.00	.0914 VL	2.00	.128 VL	2.00	.1070 VL	2.00	.130 VL	2.00
N067	2.9	9.00	1.7	9.00	2.0	8.00	1.68	7.00	1.80	8.50
N119	4.76 VH	12.00	4.20 VH	13.00	4.43 VH	13.00	4.20 VH	13.00	4.22 VH	13.00
N138C	2.38	5.00	1.56	5.00	1.84	6.00	1.39	5.00	1.62	6.00
MEDIAN CONC.	2.610		1.610		1.900		1.600		1.740	
X	2.63		1.66		1.93		1.59		1.70	
S	1.43		1.03		1.10		1.02		1.01	
n	13		13		13		13		13	
l	13		13		13		13		13	

Table A-3. Total Cadmium (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N003	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00	<5.	0.00
N006	4. VH	21.00	6. VH	24.50	8. VH	26.00	8. VH	28.00	4. H	20.00
N008	3.	16.50	4.	16.50	6.	17.50	6. VH	23.00	3.	14.00
N010C	4.72 VH	23.00	6.45 VH	27.00	6.95 H	24.00	6.40 VH	25.00	3.20	16.00
N012	2.24	16.00	4.62	18.00	6.45	20.00	4.93	21.00	2.12	9.00
N019	1.84	11.00	3.37	11.00	6.77 H	23.00	3.60	13.00	3.56 H	18.00
N019B	<5.0	0.00	<5.0	0.00	<5.0	0.00	<5.0	0.00	<5.0	0.00
N023	3.	18.50	6. VH	24.50	6.	17.50	4.	16.50	<2.	0.00
N024	1.1	6.00	3.7	13.00	9.5 VH	28.00	4.8	20.00	2.2	10.00
N030	1.6	8.00	3.8	8.50	4.1	7.00	3.2	9.00	1.7	5.50
N030B	<.5 L	2.00	2.25 L	5.00	4.0	5.00	3.0	7.50	1.0 L	2.50
N041	1.70	9.50	.67 VL	1.00	4.7	8.00	2.39	3.00	.07 VL	1.00
N051B	1.5	7.00	3.0	8.50	4.5	9.00	3.5	12.00	1.0 L	2.50
N054	1.06	5.00	2.77	7.00	4.77	12.00	3.99	16.00	1.46	4.00
N057	<2.0	0.00	3.5	12.00	4.8	13.00	3.3	10.50	<2.0	0.00
N057B	1.7	9.50	4.0	16.50	4.6	10.50	3.3	10.50	1.7	5.50
N058	<2.00	0.00	5.01	20.00	6.02	19.00	3.67	14.00	<2.00	0.00
N060	<1.	0.00	2. L	2.50	<1. VL	1.00	2. L	2.00	<1.	0.00
N062	3.4	17.00	5.2	21.00	4.0	5.00	<2.0 L	1.00	8.6 VH	21.00
N065	4.13 VH	22.00	6.36 VH	26.00	9.40 VH	27.00	7.76 VH	27.00	3.16	15.00
N071	2.1	14.50	3.9	15.00	4.6	10.50	4.0	16.50	2.3	11.00
N074	2.1	14.50	4.9	19.00	8.5	21.50	4.8	19.00	2.5	12.00
N074B	1.9	12.00	4.8	14.00	5.0	14.00	3.8	15.00	1.9	7.00
N0A9	2.0	13.00	5.5 H	22.00	6.3	15.00	6.1 VH	24.00	2.0	8.00
N093	.5 L	4.00	3.1	10.00	5.5	16.00	4.4	18.00	2.6	13.00
N102	<1.	0.00	2. L	2.50	4.	5.00	3.	7.50	<1.	0.00
N111	3.7 H	20.00	5.9 H	23.00	7.8 VH	25.00	5.9 VH	22.00	3.9 H	19.00
N111B	5.0 VH	24.00	6.6 VH	28.00	6.5	21.50	6.5 VH	26.00	3.4	17.00
N120	<.2 L	2.00	2.56	6.00	3.79	3.00	2.61	5.00	<.2	0.00
N120B	<.2 L	2.00	2.14 L	4.00	3.62 L	2.00	2.40	4.00	<.2	0.00
N130	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00	<10.	0.00
MEDIAN CONC.	1.950		3.850		5.150		3.735		2.300	
$\bar{x}$	2.44		4.01		5.66		4.30		2.64	
s	1.23		1.59		1.64		1.64		1.70	
n	21		28		27		27		21	
l	31		31		31		31		31	

Table A-4. Extractable Cadmium (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N002	2.1	10.00	3.9	11.00	5.9	12.00	4.0	11.50	1.9	9.00
N008	<1.	1.00	2. L	1.00	5.	10.00	4.	11.50	1.	3.00
N010D	5.81 H	12.00	5.9 VH	14.00	7.88 VH	14.00	6.48 VH	14.00	2.24	12.00
N013	1.6	8.00	3.4	7.00	4.3	6.00	3.6	9.00	1.5	7.50
N019C	3.72 VH	13.00	4.1	12.00	3.46	1.00	1.30 VL	1.00	2.55	13.00
N019D	<5.0	0.00	<5.0	0.00	<5.0	0.00	<5.0	0.00	<5.0	0.00
N021	1.8	9.00	3.8	9.50	5.2	11.00	3.8	10.00	2.0	10.00
N030C	1.2	3.50	2.6	3.00	3.5	2.50	2.9	4.00	1.1	4.00
N030D	1.45	7.00	3.65	8.00	4.65	7.00	3.55	8.00	1.4	6.00
N034	1.3	6.00	3.0	5.00	4.0	5.00	3.4	5.50	1.5	7.50
N047	10. VH	14.00	17. VH	15.00	14. VH	15.00	12. VH	15.00	8.5 VH	14.00
N058R	<2.00	0.00	3.80	9.50	4.84	9.00	3.47	7.00	<2.00	0.00
N067R	1.2	3.50	3.1	6.00	4.7	8.00	3.4	5.50	1.2	5.00
N071	1.1	2.00	2.6	3.00	3.5	2.50	2.3	2.00	.50	1.00
N093B	2.3	11.00	4.8	13.00	6.4 H	13.00	5.3 H	13.00	2.2	11.00
N119	1.24	5.00	2.6	3.00	3.7	4.00	2.7	3.00	.30	2.00
N130C	<5.	0.00	<5.	0.00	<5	0.00	<5.	0.00	<5	0.00
MEDIAN CONC.	1.525		3.650		4.700		3.550		1.500	
X	2.45		4.42		5.42		4.15		2.04	
S	2.39		3.62		2.68		2.48		1.94	
n	13		15		15		15		14	
l	17		17		17		17		17	

Table A-5. Total Cobalt (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N003	<20.	0.00	<20.	0.00	<20.	0.00	<20.	0.00	41.2	10.00
N006	34. VH	28.00	38. VH	28.00	30. VH	27.00	25. VH	27.00	65. VH	31.00
N008	26.	24.00	20.	25.00	20.	23.00	20.	25.00	50.	24.00
N010	24.8	23.00	18.	20.50	19.	22.00	18.	23.00	25.	18.50
N012	14.7	6.00	10.3	4.00	9.71	3.00	6.42	2.00	33.15 L	2.00
N019	19.8	14.00	13.4	11.00	15.4	17.00	16.7	22.00	43.7	15.00
N019B	21.2	20.00	14.8	16.00	17.1	20.00	14.5	18.00	45.6	21.00
N023	29. H	25.00	27. VH	26.00	31. VH	28.00	27. VH	28.00	62. VH	30.00
N024	22.4	21.00	18.2	22.00	15.2	16.00	10.6	7.00	50.4	25.00
N030	17.	10.50	14.	14.00	14.	14.00	13.	15.50	42.	12.00
N030R	14.5	5.00	11.	3.50	10.	4.50	8.	4.00	42.5	14.00
N051	14.5	17.00	13.8	12.00	13.8	11.00	11.5	11.00	48.	22.00
N053	64. VH	30.00	44. VH	30.00	44. VH	30.00	44. VH	30.00	86. VH	33.00
N057	18.	14.00	14.	14.00	12.	7.00	9.	5.50	38.	5.00
N057R	9. L	1.00	15.	18.50	16.	18.00	14.	17.00	36.	4.00
N058	17.2	12.00	12.1	8.00	16.2	19.00	14.6	19.00	45.4	20.00
N060	14.	4.00	6. L	1.00	10.	6.00	13.	15.50	30.	7.00
N062	20.6	19.00	14.8	13.00	20.6	24.00	15.2	20.00	50.7	26.00
N065	36.2 VH	29.00	37.6 VH	29.00	38.2 VH	29.00	36.9 VH	29.00	57.5 H	29.00
N073	16.	7.50	12.	7.00	10.	4.50	11.	8.50	40.	7.00
N074	<80.	0.00	<80.	0.00	<80.	0.00	<80.	0.00	<80.	0.00
N074A	23.0	22.00	18.0	20.50	17.3	21.00	15.3	21.00	45.0	18.50
N076	16.7	9.00	13.1	10.00	13.2	10.00	11.3	10.00	40.9	9.00
N089	30.1 H	26.00	19.9	24.00	20.8	25.00	18.2	24.00	49.2	23.00
N102	15.	14.00	15.	18.50	13.	8.50	12.	13.00	42.	12.00
N104	16.	7.50	11.	5.50	14.	14.00	9.	5.50	40.	7.00
N109R	17.	10.50	13.	9.00	14.	14.00	11.	9.50	42.	12.00
N111	31.9 VH	27.00	29.3 VH	27.00	26.7 H	26.00	22.8 H	26.00	51.5	27.00
N111R	67.9 VH	31.00	49.2 VH	31.00	49.1 VH	31.00	45.5 VH	31.00	81.7 VH	32.00
N120	11.8	3.00	6.65 L	2.00	7.02 L	2.00	7.31	3.00	53.3	24.00
N120R	10.1	2.00	6.76 L	3.00	6.81 L	1.00	5.94	1.00	34.7	8.00
N130	<50.	8.00	<50.	0.00	<50	0.00	<50.	0.00	<50.	0.00
N130R	<25.	0.00	<25.	0.00	<25.	0.00	<25.	0.00	<25. VL	1.00
N136	18.0	14.00	14.8	14.00	13.0	8.50	11.7	12.00	44.6	17.00
N137	18.2	16.00	14.9	17.00	13.9	12.00	12.1	14.00	44.3	16.00
MEDIAN CONC.	18.200		14.800		15.200		13.000		44.600	
$\bar{x}$	23.07		18.13		18.42		16.47		47.85	
s	13.24		10.32		10.30		9.98		11.85	
n	31		31		31		31		32	
l	35		35		35		35		35	

Table A-6. Extractable Cobalt (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N006	24.	13.00	22. H	14.00	23. H	14.00	18.	14.00	48.	14.00
N010A	17.	5.50	11.	3.00	12	5.50	11.	5.00	36.	4.00
N017	18.4	8.00	13.4	5.00	10.7	3.00	14.1	9.00	39.5	6.00
N019C	14.5	3.00	13.9	7.00	15.1	9.00	13.2	8.00	33.6	3.00
N019D	17.1	7.00	15.3	9.00	16.4	10.00	14.9	10.00	36.9	5.00
N030C	20.	10.00	16.	10.50	14	7.00	12	6.00	44	9.00
N030D	20.	10.00	16.	10.50	14.5	8.00	12.5	7.00	41.	11.50
N034	14.	4.00	13.5	6.00	11.5	4.00	9.5	4.00	40.5	7.00
N047	20.	10.00	19.	12.00	19.	13.00	16.	13.00	56.	11.50
N054A	2.81 VL	1.00	2.91 L	1.00	3.10 L	1.00	2.75 L	1.00	22.7 VL	1.00
N067	21.	12.00	14.	8.00	17	11.00	15.	11.50	44.	9.00
N071	17.	5.50	17.	4.00	12	5.50	8.8	3.00	32.	2.00
N119	28. H	14.00	20.	13.00	18.	12.00	15.	11.50	44.	9.00
N130C	10.	2.00	10.	2.00	10.	2.00	7.	2.00	47.	13.00
MEDIAN CONC.	17.750		13.950		14.250		12.850		42.250	
$\bar{X}$	17.49		14.29		14.02		12.13		40.01	
S	6.03		4.67		4.79		4.04		7.14	
n	14		14		14		14		14	
1	14		14		14		14		14	

Table A-7. Total Copper (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N003	91.3 H	31.50	86.3	26.00	108.	25.50	13.2	24.00	572.	21.00
N006	80.	18.50	69.	10.00	100.	9.50	80. L	14.50	590.	28.50
N008	80.	18.50	78.	6.50	96.	5.00	96. VH	33.00	560.	15.00
N010C	94.	25.00	85.	23.00	108.	25.50	86.	28.50	592.	30.00
N012	73.15	6.00	71.45 L	2.00	93.0 L	2.00	68.4 VL	3.00	484.5 L	3.00
N015	85.8	29.00	84.8	22.00	107	22.50	85.1	27.00	587.	27.00
N019	79.4	15.50	109. VH	34.00	105	18.00	81.8	20.00	550.	10.50
N019B	71.1 L	4.00	100. VH	32.00	96.7	6.00	74.6	6.00	540.	6.50
N023	95. VH	34.00	84.	20.00	100.	8.50	78.	11.50	554.	12.00
N024	91.3 H	31.50	86.6	27.50	109.	29.50	87.0	30.00	622. H	33.00
N030	80.	18.50	81.	13.00	95	4.00	79.	13.00	577.	23.50
N030B	94.5 VH	33.00	101. VH	33.00	125.5 VH	34.00	98. VH	34.00	625. H	34.00
N041	20.5 VL	1.00	82.7	16.00	109.	29.50	15.2 VL	1.00	560.	15.00
N051	76.	8.50	78.	6.50	100.	9.50	75.	9.00	560.	15.00
N053	49. VL	2.00	50. VL	1.00	65 VL	1.00	58. VL	2.00	365. VL	2.00
N057	81.	21.00	81.	13.00	104.	14.00	80.	14.50	558.	13.00
N057B	70. L	3.00	83.	17.00	105.	18.00	81.	18.00	590.	28.50
N058	77.1	12.00	86.6	27.50	108.	25.50	82.9	23.00	550.	10.50
N060	78.2	13.00	81.0	13.00	102.	13.00	74.9	7.00	575.	22.00
N062	79.4	15.50	79.9	9.00	104.2	15.00	80.8	16.00	580.2	25.00
N065	86.8	30.00	87.9	30.00	109.	29.50	80.9	17.00	56.2 VL	1.00
N073	76.	8.50	76.	5.00	101.	12.00	75.	9.00	543.	8.00
N074	75.0	8.50	79.0	8.00	105.	18.00	82.0	21.50	630. H	35.00
N074B	77.0	5.00	72.0 L	3.00	94.0 L	3.00	70.0 L	4.00	540.	6.50
N089	78.9	14.00	83.9	19.00	111.	33.00	93.0 H	32.00	547.	9.00
N093	92.2	23.00	83.7	18.00	106.0	24.00	81.4	19.00	603.2	31.00
N102	84.	25.00	86.	24.00	110.	32.00	86.	28.50	565.	18.00
N109	76.	8.50	73. L	4.00	98.	7.00	72. L	5.00	522.	4.00
N109B	80.	18.50	82.	15.00	105	18.00	78.	11.50	568.	20.00
N111	91.2	22.00	84.4	21.00	107	22.50	82.0	21.50	563.	17.00
N111B	84.8	27.00	86.2	25.00	108.	25.50	84.0	25.00	577.	23.50
N120	84.9	28.00	86.8	29.00	109.	29.50	84.9	26.00	567.	19.00
N120B	76.5	11.00	80.2	11.00	100	9.50	75.8	9.00	530.	5.00
N130	94.	25.00	89.	31.00	105	18.00	88.	31.00	582.	26.00
N136	<400.	0.00	<400.	0.00	<400.	0.00	<400.	0.00	620.	32.00
MEDIAN CONC.	80.000		83.350		105.000		80.950		565.000	
$\bar{x}$	78.27		82.94		103.19		78.50		548.72	
s	13.07		9.57		9.16		14.03		97.15	
n	34		34		34		34		35	
l	35		35		35		35		35	

Table A-8. Extractable Copper (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N002	61.0 VL	3.00	62.7 VL	3.00	80.6 VL	3.00	68.0 L	3.00	485 L	2.00
N005	78.	8.50	78.	7.00	103.	11.50	83.	14.00	564.	9.00
N010D	81.	14.50	80.	9.50	103.	11.50	82.	12.50	503. L	6.00
N013	100. VH	17.00	94.0 VH	17.00	114. H	17.00	103. VH	17.00	679 VH	17.00
N019C	77.5	7.00	78.1	8.00	102	8.50	80.6	11.00	530	7.00
N019D	73.3	5.00	71.1 L	4.00	95.2	4.00	69.9 L	4.00	501. L	5.00
N021	77.	6.00	75.	5.00	103.	11.50	76.	5.00	565.	8.00
N030C	81.	14.50	81.	12.50	101.	7.00	80.	10.00	600.	15.00
N030D	72.5	4.00	77.5	6.00	100.5	6.00	79.5	9.00	579.0	11.00
N034	80.	11.50	80.5	11.00	103.	11.50	78.	7.00	587.	13.00
N047	80.	11.50	90. H	16.00	110.	15.50	85.	16.00	500. L	4.00
N058D	36.4 VL	1.00	30.6 VL	1.00	74.5 VL	2.00	57.3 VL	1.00	358. VL	1.00
N067	82.	16.00	81.	12.50	100	5.00	79.	8.00	570	10.00
N071	80.	11.50	84.	14.00	105	14.00	84.	15.00	580.	12.00
N093B	55.3 VL	2.00	58.1 VL	2.00	61.4 VL	1.00	65.2 VL	2.00	486.5 L	3.00
N119	78.	8.50	80.	9.50	102.	8.50	77.	6.00	650. VH	16.00
N130C	80.	11.50	86.	15.00	110.	15.50	82.	12.50	598.	14.00
MEDIAN CONC.	78.000		80.000		102.000		79.500		564.000	
$\bar{x}$	74.88		75.98		97.54		77.62		547.97	
s	13.60		14.88		14.82		11.33		75.05	
n	17		17		17		17		17	
l	17		17		17		17		17	

Table A-9. Total Iron (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N003	4.44	6.50	6.33	31.00	3.70	24.50	3.37	28.50	3.30	13.50
N006	4.90	18.00	6.00	20.00	3.60	17.00	3.20	19.50	3.50	24.50
N008	3.80 VL	4.00	4.40 VL	3.00	2.80 VL	2.00	2.35 VL	2.00	2.65 VL	2.00
N010	3.73 VL	3.00	4.06 VL	1.00	3.06 L	3.00	2.87	9.00	3.10	9.00
N012	3.50 VL	1.00	4.28 VL	2.00	2.44 VL	1.00	1.90 VL	1.00	2.27 VL	1.00
N015	5.05	21.50	6.12	23.00	3.61	18.50	3.45	33.00	3.61	30.00
N016	5.26	33.50	6.24	25.50	3.95	32.50	3.44	31.50	3.79	35.00
N019B	5.25	33.50	6.44	35.00	3.95	32.50	3.61 H	36.00	3.41 H	33.00
N023	3.64 VL	2.00	5.64	9.00	7.28 VH	36.00	3.04	13.00	3.36	17.00
N024	5.29	35.00	6.51	36.00	6.10 H	35.00	3.51	34.50	3.66	21.00
N030	4.83	14.00	6.00	20.00	3.50	12.00	3.20	19.50	3.58	13.50
N030A	5.38	36.00	6.32	29.50	3.70	24.50	3.31	25.00	3.77	34.00
N041	4.78	13.00	5.67	10.00	3.34 L	8.00	3.10	14.00	3.25	11.00
N061	4.46	6.50	5.91	16.00	3.13 L	5.00	2.62 VL	4.00	2.95 L	8.00
N062	5.14	27.00	5.79	14.00	3.08 L	4.00	2.73 L	5.00	3.40	19.00
N0579	5.1	25.50	6.3	27.50	3.7	24.50	3.3	23.50	3.6	29.00
N05A	5.20	30.50	6.41	33.00	3.98	34.00	3.51	34.50	3.65	32.00
N060	5.24	32.00	6.06	22.00	3.43	30.00	2.96	12.00	3.50	24.50
N062	5.05	21.50	6.00	20.00	3.67	21.00	3.22	21.00	3.41	23.00
N065	4.00 VL	5.00	4.80 VL	4.00	3.20	7.00	2.80 L	7.00	2.80 VL	3.00
N073	4.66	10.00	5.42	6.00	3.47	11.00	2.49	10.00	2.47 L	5.00
N074	4.96	20.00	5.97	18.00	3.70	24.50	3.32	29.00	3.50	24.50
N074B	4.78	11.50	5.30 L	5.00	3.15 L	6.00	2.83	8.00	3.23	10.00
N076	4.55	8.00	5.48	7.00	3.39	10.00	2.94	11.00	3.03	8.00
N089	5.10	25.50	5.56	8.00	3.37	9.00	2.55 VL	3.00	2.86 L	4.00
N093	4.70	11.50	5.94	17.00	3.55	13.00	3.57	15.50	3.52	12.00
N102A	5.09	23.50	6.14	24.00	3.69	22.00	3.35	27.00	3.58	27.50
N109	4.87	16.00	5.77	13.00	3.56	15.00	3.14	15.00	3.34	15.50
N109B	4.94	19.00	5.90	15.00	3.56	15.00	3.15	16.50	3.39	18.00
N111	4.64	9.00	5.75	11.50	3.62	20.00	3.18	14.00	3.34	15.50
N111B	5.2	30.50	6.3	27.50	3.8	29.00	3.4	30.00	3.7	33.00
N120A	5.09	23.50	6.38	32.00	3.85	31.00	3.44	31.50	3.50	24.50
N120B	4.86	15.00	5.75	11.50	3.56	15.00	2.74 L	6.00	3.01	7.00
N130	5.17	29.00	6.43	34.00	3.79	28.00	3.30	23.50	3.48	22.00
N136	5.16	24.00	6.32	29.50	3.75	27.00	3.37	28.50	3.64	31.00
N137	4.89	17.00	6.24	25.50	3.61	18.50	3.29	22.00	3.52	27.50
MEDIAN CONC.	4.920		5.985		3.610		3.190		3.395	
$\bar{X}$	4.80		5.83		3.64		3.10		3.32	
S	0.49		0.61		0.71		0.36		0.34	
n	36		36		36		36		36	
l	36		36		36		36		36	

Table A-10. Extractable Iron (pooled data)

SAMPLE LAB NO	1 REPORTED VALUE	RANK	2 REPORTED VALUE	RANK	3 REPORTED VALUE	RANK	4 REPORTED VALUE	RANK	5 REPORTED VALUE	RANK
N002	.296 VL	2.00	.213 VL	2.00	.059 VL	1.00	.113 VL	1.00	.176 VL	2.00
N005	5.78	9.00	4.54	7.00	2.92	10.00	2.30	8.50	2.53	6.00
N010B	3.41 L	5.00	4.35	5.00	2.58	5.00	2.26	6.50	2.30	5.00
N013	4.14	7.00	4.74	10.00	2.89	9.00	2.26	6.50	2.65	8.00
N019C	4.42	10.00	4.49	6.00	2.71	7.00	2.38	10.00	2.58	7.00
N019D	4.69	13.00	4.90	11.00	3.23	13.00	2.53	11.00	2.99	9.00
N021	4.16	8.00	4.85	12.00	2.86	8.00	2.18	5.00	3.41 H	17.00
N030C	4.50	11.00	5.70 H	13.00	3.00	11.00	2.60	12.50	3.00	12.50
N030D	4.79	15.50	5.85 H	16.00	3.24	14.00	2.80	16.00	3.30 H	16.00
N034	4.79	15.50	4.65	8.00	3.31	15.00	2.83	17.00	2.98	11.00
N047	4.66	12.00	5.9 VH	17.00	3.4	17.00	2.9	14.00	3.0	12.50
N058A	.218 VL	1.00	.194 VL	1.00	.246 VL	3.00	.168 VL	2.00	.105 VL	1.00
N067	4.0	6.00	4.7	9.00	2.7	6.00	2.30	8.50	2.70	10.00
N071	2.80 VL	4.00	3.00 VL	3.00	2.10 L	4.00	1.70 L	4.00	2.00 L	4.00
N093B	2.06 VL	3.00	1.47 VL	1.00	.240 VL	2.00	.800 VL	3.00	1.25 VL	3.00
N119	5.19 H	17.00	5.75 H	14.00	3.16	12.00	2.73	15.00	3.16	14.00
N130C	4.78	14.00	5.82 H	15.00	3.34	16.00	2.60	12.50	3.20	15.00
MEDIAN CONC.	4.280		4.700		2.890		2.300		2.690	
$\bar{x}$	3.71		4.19		2.47		2.07		2.41	
S	1.52		1.87		1.14		0.87		1.00	
n	17		17		17		17		17	
l	17		17		17		17		17	

Table A-11. Total Manganese (pooled data)

SAMPLE LAB NO	1 REPORTED VALUE		1 RANK	2 REPORTED VALUE		2 RANK	3 REPORTED VALUE		3 RANK	4 REPORTED VALUE		4 RANK	5 REPORTED VALUE		5 RANK
N006	2330.		24.00	1240.		22.00	600.		26.00	560.		27.50	610.		25.50
N008	2300.		21.00	1260.		25.00	550		6.50	500.		9.00	600.		21.00
N010	2315.		23.00	1002.	VL	2.00	434	VL	2.00	465.	L	6.00	498.	L	3.00
N012	2045.		6.00	21.5	VL	1.00	10.0	VL	1.00	8.63	VL	1.00	8.08	VL	1.00
N015	2420.		30.50	1330.		32.00	595		23.00	545		21.00	624.		28.00
N016	2370.		27.00	1230.		20.00	575.		14.00	535.		15.00	574.		13.50
N019R	2420.		30.50	1200.		15.00	574.		13.00	540.		17.00	605.		23.00
N023	1770.	VL	2.00	1310.		31.00	588.		18.50	544.		20.00	562.		12.00
N030	2100.		8.50	1230.		20.00	540		20.50	550.		23.50	600.		21.00
N030B	2135.		12.00	1090.	L	5.00	557.5		8.00	510.		10.00	585.		18.00
N051	2470.		32.00	1200.		15.00	550		6.50	475.	L	7.00	580.		17.00
N053	2200.		14.00	1200.		15.00	600.		26.00	530.		27.50	600.		21.00
N057	1920.	VL	4.00	1290.		29.00	600		26.00	330.	VL	2.00	510	L	8.00
N057B	1930.	VL	1.00	1060.	L	4.00	590		20.50	550		23.50	610		25.50
N058	2110.		10.00	1250.		25.00	584.		17.00	511.		18.00	609.		24.00
N062	2282.		20.00	1245.		23.00	636.		30.00	574.		29.00	621.		27.00
N065	2100.		8.50	1100.		6.50	596.		24.00	535.		15.00	552.		11.00
N073	2310.		22.00	1140.		11.00	556		9.00	434		8.00	521.	L	7.00
N074	2260.		17.50	1130.		8.00	560		10.50	530.		12.00	540.		10.00
N074B	2160.		13.00	1070.	L	3.00	495.	VL	3.00	460.	L	5.00	530.		8.00
N076	2230.		15.00	1260.		25.00	579.	L	15.00	551.		25.00	573.		14.00
N089	2330.		24.00	1160.		10.00	520.	H	4.00	420.	VL	3.00	490	VL	2.00
N093	1822.	VL	2.00	1180.		11.50	573		12.00	535.		15.00	502.	L	5.00
N102	2269.		17.50	1270.		27.00	645.		31.50	592.		31.00	647.	H	32.00
N109	2373.		25.00	1195.		13.00	583.		16.00	546.		22.00	587.		19.00
N109B	2247.		16.00	1209.		17.00	594.		22.00	542.		19.00	569.		13.00
N111	2038.		7.00	1223.		18.00	588		18.50	557.		25.00	574.		15.50
N111B	2369.		26.00	1273.		28.00	604		28.00	604.	H	34.00	677.	VH	33.00
N120	2530.	H	34.00	1350.	H	34.00	697.	VH	34.00	516.		13.00	637.		30.00
N120B	1960.	L	5.00	1100.		5.00	575.		5.00	439.	VL	2.00	500.	L	4.00
N130	2270.		19.00	1230.		20.00	610.		29.00	597.		30.00	625.		29.00
N130B	2116.		11.00	1135.		9.00	560		10.50	512.		11.00	535.		9.00
N136	2489.	H	33.00	1332.		33.00	649.	H	33.00	602.	H	33.00	691.	VH	34.00
N137	2413.		29.00	1302.		30.00	645	H	31.50	594.		32.00	641.	H	31.00
MEDIAN CONC.	2250.000			1216.000			586.000			540.500			582.500		
$\bar{x}$	2197.06			1171.99			565.81			514.17			564.33		
S	270.17			219.46			108.81			102.55			110.82		
n	34			34			34			34			34		
l	34			34			34			34			34		

Table A-12. Extractable Manganese (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N002	2220.	9.00	970. L	3.00	370. VL	4.00	340. VL	4.00	440.	4.00
N005	2280.	10.00	1090.	8.00	480.	7.00	335.	5.00	480.	7.00
N010A	2004.	4.00	1050.	7.00	477.	6.00	416.	9.00	446.	5.00
N013	2404.	15.00	1152.	10.00	498.	9.00	419.	11.00	527.	13.00
N019C	2340.	14.00	1190.	13.00	530.	13.00	425.	12.00	500.	11.00
N019D	2320.	12.00	1160.	11.00	526.	12.00	415.	8.00	490.	9.50
N021	2200.	7.50	1100.	9.00	511.	11.00	405.	7.00	483.	8.00
N030C	2280.	7.50	1280. VH	16.00	570. H	16.00	490. H	16.00	570. VH	15.50
N030D	2310.	11.00	1165.	12.00	508.5	10.00	446.	13.00	544.5 H	14.00
N034	2480. H	16.00	1250. H	14.00	557. H	14.00	489. H	15.00	524.	12.00
N058B	1910. L	2.00	734. VL	1.00	241. VL	1.00	243. VL	1.00	300. VL	1.00
N067	2100.	6.00	1000.	4.50	470.	5.00	400.	6.00	490.	9.50
N071	1500. VL	1.00	1000.	4.50	320. VL	3.00	254. VL	2.00	320. VL	2.00
N093A	2061.	5.00	957. L	2.00	303. VL	2.00	296. VL	3.00	364. VL	3.00
N119	1941. L	3.00	1045.	6.00	493.	8.00	418.	10.00	478.	6.00
N130C	2330.	13.00	1260. VH	15.00	560 H	15.00	480. H	14.00	570. VH	15.50
MEDIAN CONC.	2210.000		1095.000		495.500		415.500		486.500	
X	2162.50		1087.69		465.91		395.69		470.41	
S	241.69		139.91		94.12		75.92		80.77	
n	16		16		16		16		16	
l	16		16		16		16		16	

Table A-13. Total Nickel (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N003	46.2 L	2.00	<20. VL	1.00	<20 VL	1.00	33.1	7.00	990.	27.00
N006	82. VH	31.00	73. VH	29.00	64 VH	29.00	61. VH	30.00	1080. H	33.00
N009	70.	26.00	60.	22.00	50	23.00	45.	21.50	960.	22.00
N010	65.	23.00	55.	19.00	43	13.00	38.	16.00	911.	9.00
N012	48.95	4.00	43.75	5.00	39.95	5.00	28.85	2.00	760. VL	2.00
N015	30.7 VL	1.00	42.2 L	4.00	27.1 VL	2.00	17.6 VL	1.00	861.	4.00
N019	51.3	7.00	41.7 L	3.00	36.9	4.00	31.7	3.00	896.	8.00
N019B	59.3	17.00	51.6	13.00	46.8	19.00	37.3	15.00	936.	14.00
N023	51.	5.50	75. VH	30.00	57 H	27.00	51. H	27.00	1000.	28.50
N024	72.8 H	27.00	63.9	23.00	56.8 H	26.00	49.7	25.00	1155. VH	34.00
N030	58.	12.50	54.	15.50	44.	16.00	39.	17.00	945.	14.00
N030B	56.5	10.00	52.5	14.00	39	7.00	37.0	12.50	955.	21.00
N041	85.7 VH	32.00	71.3 H	27.00	83.6 VH	32.00	61.3 VH	31.00	931.	13.00
N051	60.	18.00	60.	9.50	40	8.00	35.	8.00	1020.	30.00
N053	51.	5.50	38. L	2.00	35.	3.00	33.	5.50	625. VL	1.00
N057	52.	19.00	50.	9.50	42.	10.00	33	5.50		0.00
N057B	48.	3.00	58.	21.00	50	23.00	43.	20.00	1055. H	32.00
N058C	58.6	15.00	54.4	17.50	43.7	15.00	39.7	18.50	939.	16.00
N060	64.	20.00	54.	15.50	50.	23.00	45.	21.50	926.	10.00
N062	53.6	8.00	45.5	6.00	42.4	11.00	36.6	10.00	1044. H	31.00
N065	69.7	25.00	71.4 VH	28.00	64.1 VH	30.00	58.7 VH	29.00	927.	11.00
N073	59.	16.00	51.	12.00	43.	13.00	37.	12.50	972.	25.00
N074	<100.	0.00	<100.	0.00	<100.	0.00	<100.	0.00	1000.	28.50
N074B	58.0	12.50	50.0	9.50	41.0	9.00	36.0	9.00	940.	16.50
N075	58.	12.50	<45.	0.00	<45.	0.00	<40	0.00	940.	16.50
N089	54.8	22.00	56.1	20.00	47.3	20.00	39.7	18.50	895.	7.00
N102	58	12.50	50.	9.50	43.	13.00	37.	12.50	929.	12.00
N109	66.	24.00	65.	24.00	48.	21.00	46.	23.50	963.	23.00
N109B	77. H	28.00	66. H	25.00	52.	25.00	46.	23.50	954.	20.00
N111	77.3 VH	29.00	69.8 H	26.00	51.8 VH	28.00	45.5 VH	28.00	875.	5.00
N111B	92.8 VH	33.00	79.5 VH	32.00	75.2 VH	31.00	66.9 VH	32.00	988.	24.00
N120	64.2	21.00	54.4	17.50	44.2	17.00	37.0	12.50	941.	18.00
N120B	56.3	9.00	49.3	7.00	38.8	6.00	31.8	4.00	876.	6.00
N130	78. VH	30.00	78. VH	31.00	46.	18.00	42. H	26.00	987.	26.00
N136	<100.	0.00	<100.	0.00	<100	0.00	<100.	0.00	1160 VH	35.00
N137	<100.	0.00	<100.	0.00	<100.	0.00	<100.	0.00	783. VL	3.00
MEDIAN CONC.	59.300		54.200		44.100		38.600		941.000	
$\bar{X}$	62.14		57.17		48.15		41.70		945.69	
s	12.54		11.19		11.87		10.65		99.16	
n	33		31		31		32		35	
l	36		36		36		36		36	

Table A-14. Extractable Nickel (pooled data)

SAMPLE LAB NO	1 REPORTED VALUE	RANK	2 REPORTED VALUE	RANK	3 REPORTED VALUE	RANK	4 REPORTED VALUE	RANK	5 REPORTED VALUE	RANK
N002	43.3 L	2.00	30.3 VL	2.00	18.0 VL	2.00	25.5	3.00	648. VL	2.00
N005	62.	14.00	53.	12.00	45.	11.50	36.	12.00	925.	11.00
N010B	48.	3.00	48.	8.50	42.	11.50	30.	6.00	780.	4.00
N013	54.	7.00	42.	4.00	32.	3.00	30.	6.00	882.	9.00
N019C	49.0	4.00	43.5	5.00	34.7	5.00	25.2	2.00	774.	3.00
N019D	58.1	9.00	47.1	7.00	38.9	7.00	32.9	8.00	795	5.00
N021	57	8.00	48.	8.50	40	8.00	33.	9.00	904.	10.00
N030C	61.	12.00	55.	13.00	43.	13.00	39.	13.00	990. H	14.00
N030D	59.	11.00	51.	10.50	41.	10.00	35.5	11.00	967.5 H	13.00
N034	58.5	10.00	51.	10.50	40.5	9.00	34.5	10.00	993. H	15.00
N047	64.	14.00	59. H	14.00	50	15.50	42.	14.00	810.	6.00
N058B	16.8 VL	1.00	12.2 VL	1.00	9.93 VL	1.00	9.45 VL	1.00	467. VL	1.00
N067	51.	5.00	40.	3.00	33.	4.00	29.	4.00	850.	8.00
N071	53.	6.00	46.	6.00	35.	6.00	30.	6.00	830.	7.00
N119	67.	15.00	62. H	15.50	49	14.00	43. H	15.00	995. H	16.00
N130C	68.	16.00	62. H	15.50	50	15.50	44. H	16.00	937.	12.00
MEDIAN CONC.	57.550		48.800		40.250		32.950		866.000	
X	54.29		46.88		37.43		32.44		846.72	
S	12.17		12.40		10.80		8.43		140.25	
n	16		16		16		16		16	
1	16		16		16		16		16	

Table A-15. Total Lead (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N003	89.0	20.00	233.	12.00	284.	27.00	167.	24.00	94.1 VH	20.00
N006	100.	25.00	260.	24.00	310 VH	30.00	140 H	29.00	80. H	26.00
N008	102.	26.00	247.	20.00	266.	23.00	168. H	25.00	65.	24.00
N010C	64. L	2.00	180. VL	2.00	144. VL	2.00	120.	3.00	51.	10.50
N012	66.5 L	3.00	200.5 L	4.00	218.5 L	4.00	119.5	2.00	43.8	4.00
N019A	114. VH	27.00	270.	25.00	265.	22.00	170. H	26.50	103. VH	30.00
N023	51.	9.50	140. VL	1.00	130. VL	1.00	90. VL	1.00	45.	6.50
N024	92.4	22.00	237.	14.00	264.	21.00	148.	20.00	66.0	25.00
N030	74.	4.00	219.	7.00	229.	5.50	131.	7.50	51.	10.50
N030A	93.5	23.00	237.5	15.00	242.5	10.00	147.0	19.00	64.2	23.00
N041	123. VH	30.00	296. VH	29.00	309 VH	29.00	185. VH	30.00	9.66 VL	1.00
N051B	85.	15.00	245.	18.00	260.	20.00	145.	18.00	45.	6.50
N053	84.	14.00	195. L	3.00	203. L	3.00	126.	5.00	62.	20.00
N057	78.	8.00	220.	8.00	240.	9.00	132.	9.00	42. L	2.00
N057B	62. L	1.00	244.	21.50	251	13.50	143.	16.00	64.	21.50
N058	118. VH	28.00	273.	27.00	288	28.00	175 H	28.00	98.7 VH	29.00
N060B	82.	11.00	255.	23.00	272.	24.00	150.	22.00	58.	17.00
N062	77.	7.00	234.	13.00	256.	17.00	138.	11.50	53.	13.00
N065	276. VH	32.00	681. VH	32.00	692. VH	32.00	412. VH	32.00	150 VH	32.00
N073	81.	9.50	248.	21.50	263	16.00	138.	11.50	49.	8.00
N074	75.0	5.00	245.	18.00	260.	12.00	140.	14.00	60.0	19.00
N074B	83.0	13.00	225.	9.00	230.	7.00	125.	4.00	55.0	15.00
N089	91.2	21.00	352. VH	31.00	258.	18.00	150.	22.00	52.7	12.00
N093	121. VH	29.00	276.	28.00	282	26.00	170. H	26.50	84.5 VH	27.00
N102	87.	18.50	241.	16.00	252.	15.00	141.	15.00	58.	17.00
N109	87.	18.50	229.	10.50	251.	13.50	139.	13.00	58.	17.00
N109B	86.	17.00	245.	18.00	269.	19.00	150.	22.00	64.	21.50
N111	85.3	16.00	229.	10.50	243.	11.00	135.	10.00	43.7	3.00
N111B	163. VH	31.00	320. VH	30.00	346 VH	31.00	253. VH	31.00	107. VH	31.00
N120	82.5	12.00	208. L	5.00	231.	8.00	131.	7.50	50.	9.00
N120B	75.8	6.00	210.	6.00	229.	5.50	129.	6.00	44.1	5.00
N130	98.	24.00	272.	26.00	278.	25.00	144.	17.00	54.	14.00
MEDIAN CONC.	85.650		243.000		254.500		143.500		58.000	
$\bar{X}$	96.35		255.34		265.19		155.98		63.31	
S	38.83		87.02		88.14		54.28		25.55	
n	32		32		32		32		32	
l	32		32		32		32		32	

Table A-16. Extractable Lead (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N002	64.6	4.00	217.	4.00	209. L	3.00	132.	6.00	52.4	9.00
N005	98. H	13.00	257.	12.00	271	13.00	142.	10.00	62.	14.00
N010D	57.	5.00	212.	3.00	238.	6.00	118.	2.00	43.	2.50
N013	96. H	11.00	285. VH	14.00	272.	14.00	154.	13.00	56.	12.00
N019D	97.3 H	12.00	234.	4.00	262.	12.00	120.	9.00	59.5	13.00
N021	79.	9.50	241.	11.00	255	10.00	135.	8.00	46.	6.00
N030C	75.	7.50	222.	5.00	238.	5.00	133.	7.00	47.	7.00
N030D	79.	9.50	240.5	10.00	252	9.00	142.5	11.00	54.0	10.50
N034	75.	7.50	233.	8.00	249.	8.00	131.	5.00	45.	5.00
N047	100. H	14.50	290. VH	16.00	310. VH	16.00	180. VH	16.00	70. H	15.00
N058D	37.8 VL	1.00	77.4 VL	1.00	144 VL	1.00	72.8 VL	1.00	14.2 VL	1.00
N067	74.	6.00	200. L	2.00	210 L	4.00	120.	3.50	49.	8.00
N071	64.	3.00	228.	7.00	240.	7.00	120.	3.50	43.	2.50
N093	67.8	2.00	223.	6.00	161. VL	2.00	149.	12.00	43.1	4.00
N119	111. VH	16.00	247. VH	15.00	298 H	15.00	178. VH	15.00	78. VH	16.00
N130C	100. H	14.50	260.	13.00	260	11.00	160.	14.00	54.	10.50
MEDIAN CONC.	77.000		233.500		240.500		137.500		50.900	
X	80.03		231.87		241.44		137.96		51.04	
S	19.09		49.35		43.71		25.41		14.04	
n	16		16		16		16		16	
l	16		16		16		16		16	

Table A-17. Total Vanadium (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N006	146.	17.00	107. H	17.00	101.	17.00	82. H	18.00	126. VH	21.00
N010	138.	16.00	95.	15.50	85.	11.00	78.	13.50	70.	12.00
N012	44.15 VL	1.00	39.85 VL	1.00	44.80 VL	1.00	34.1[illegible] VL	1.00	35.70 VL	[illegible].00
N015	221. VH	22.00	135. VH	21.00	135. VH	22.00	130. VH	22.00	76.1	16.00
N019	157. H	20.00	116. VH	20.00	115. VH	19.50	106. VH	21.00	85.0	18.50
N019A	164. VH	21.00	115. H	19.00	112. VH	18.00	105. VH	20.00	88.5 H	20.00
N023	151. H	19.00	161. VH	22.00	121. VH	21.00	91. H	17.00	132. VH	22.00
N030	150. H	18.00	110. H	18.00	100.	16.00	85. H	19.00	85	18.50
N030A	116.5	7.00	81.	9.00	75.5	4.00	67.5	6.00	61.0	6.00
N051	53. VL	2.00	44. VL	2.00	50. VL	2.00	41. VL	2.00	45. VL	3.00
N053	120.	9.00	88.	11.00	115. VH	19.50	80.	16.00	76.	15.00
N057A	125.	11.50	95.	15.50	88.	13.00	79.	15.00	73.	14.00
N058	111.	5.00	85.2	10.00	78.4	5.00	70.0	9.50	68.2	9.00
N065	113.	6.00	89.7	12.00	92.0	15.00	69.9	8.00	69.8	11.00
N073	130.	14.00	79.	4.00	90.	14.00	65.	5.00	32. VL	1.00
N074A	125.	11.50	80.0	6.00	74.0	3.00	59.0	7.00	64.0	7.00
N076	120.	9.00	76.5	3.00	80.8	7.00	71.7	11.00	44.7 VL	2.00
N120	106.	4.00	80.9	8.00	82.5	8.00	60.6	4.00	80.4	17.00
N120B	104.	3.00	80.	6.00	80.	6.00	58.3	3.00	72.	13.00
N130A	120.	9.00	80.	6.00	83.	9.00	70.	9.50	60.	5.00
N136	128.	13.00	90.	13.00	86.	12.00	75.	12.00	67.	10.00
N137	136.	15.00	91.	14.00	94.	10.00	78.	13.50	66	8.00
MEDIAN CONC.	125.000		88.850		85.500		73.350		69.900	
$\bar{X}$	126.58		91.96		89.23		76.64		72.08	
S	35.16		25.91		20.41		21.18		23.32	
n	22		22		22		22		22	
l	22		22		22		22		22	

Table A-18. Extractable Vanadium (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N005	34. L	2.00	29.	2.00	30. L	2.00	23. L	2.00	33.	2.00
N0108	42.	3.00	43.	6.00	43.	5.00	43.	8.00	41.	4.00
N013	56.0	6.00	43.7	7.00	44.9	6.00	37.4	6.00	45.0	6.00
N019C	78.8 VH	10.00	49.5	8.00	63.3 H	9.00	37.9	7.00	49.0	8.00
N019D	63.4	7.00	40.1	5.00	49.8	7.00	33.2	4.00	46.1	7.00
N030C	65.	8.00	60. H	10.00	70. VH	10.00	55. VH	9.00	60. H	10.00
N030D	45.	4.00	35.5	3.00	39.5	3.00	33.	3.00	40.	3.00
N058B	6.43 VL	1.00	3.59 VL	1.00	7.79 VL	1.00	6.08 VL	1.00	3.71 VL	1.00
N067	54.	5.00	38.	4.00	42.	4.00	34.	5.00	42.	5.00
N119	73. H	9.00	54.	9.00	51.	8.00	58. VH	10.00	59. H	9.00
MEDIAN CONC.	55.000		41.550		43.950		35.700		43.500	
$\bar{X}$	51.68		39.64		44.13		36.06		41.88	
S	21.04		15.56		17.21		14.85		15.78	
n	10		10		10		10		10	
l	10		10		10		10		10	

Table A-19. Total Zinc (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N003	266.	6.50	1380.	17.50	1500.	12.00	1080.	13.00	720.	6.50
N006	280.	21.00	1480.	30.00	1620.	29.50	1160.	28.50	780.	22.50
N008	260.	2.50	1540. H	34.00	1680. H	35.00	1240. VH	36.00	860. H	36.00
N010	280.	21.00	1270.	5.00	1316 VL	2.00	998. L	4.00	680. L	3.00
N010C	270.	11.00	1180. VL	1.00	1205 VL	1.00	1005. L	5.00	800.	28.00
N012	274.	14.50	1245. L	3.00	1400.	4.50	985.5 L	3.00	648. VL	2.00
N015	305.	34.00	1560. H	36.00	1660.	34.00	1250. H	37.00	827.	33.00
N019	270.	11.00	1210. L	2.00	1340. L	3.00	966. L	1.00	705.	5.00
N019B	280.	29.50	1370.	15.50	1510	14.50	1100.	19.50	767.	18.50
N023	292. VH	38.00	1460.	28.00	1520.	17.50	1040.	7.00	946. VH	38.00
N024	299.	32.00	1420.	24.00	1534.	21.00	1158.	30.00	793.	26.00
N030	263.	5.00	1500.	32.00	1590.	28.00	1200.	35.00	780.	22.50
N030B	285.	24.50	1430.	26.00	1555	25.00	1110.	21.00	775.	20.00
N041	275.	16.50	1620. VH	37.00	1510.	14.50	1085.	15.50	764.	17.00
N051	285.	24.50	1400.	21.00	1560.	26.00	1130.	25.00	815.	29.50
N057	275.	16.50	1350.	12.00	1630.	31.00	1170.	31.00	815.	29.50
N057	262.	4.00	1370.	15.50	1515.	16.00	1065.	10.00	752.	13.00
N057B	264.	8.50	1497.	31.00	1637	32.00	1188.	34.00	831.	34.00
N058A	315. H	36.00	1400.	21.00	1650.	33.00	1150.	27.00	755.	14.50
N058C	297.	31.00	1470.	29.00	1620.	29.50	1180.	32.50	786.	24.50
N060	278.	19.00	1320.	7.50	1520.	23.00	1050.	7.00	786.	24.50
N062	269.	8.50	1386.	19.00	1532.	20.00	1120.	24.00	776.	21.00
N065	266.	6.50	1300.	5.00	1400.	4.50	970. L	2.00	630. VL	1.00
N073	274.	14.50	1350.	12.00	1490.	10.00	1080.	13.00	747.	12.00
N074	291.	29.50	1520.	33.00	1690. H	36.50	1180.	32.50	740.	10.00
N074B	270.	11.00	1320.	7.50	1460.	8.00	1040.	7.00	725.	8.00
N089	260.	2.50	1630. VH	38.00	1520	17.50	1080.	13.00	720.	6.50
N093	254.	1.00	1260. L	4.00	1409.	6.00	1050.	9.00	693. L	4.00
N102	287.	23.00	1422.	25.00	1584.	27.00	1118.	22.00	767.	18.50
N109	286.	26.00	1336.	9.00	1493.	9.00	1093.	18.00	760.	16.00
N109B	280.	21.00	1400.	21.00	1535	22.00	1142.	26.00	818.	31.00
N111	276.	14.00	1337.	10.00	1506.	13.00	1077.	11.00	745.	11.00
N111B	288.	28.00	1350.	12.00	1496.	11.00	1085.	15.50	738.	9.00
N120	287.	27.00	1440.	27.00	1690. H	36.50	1100.	19.50	821.	32.00
N120B	271.	13.00	1380.	17.50	1550.	24.00	1120.	23.00	799.	27.00
N130	300.	33.00	1410.	23.00	1530	19.00	1160.	28.50	837.	35.00
N136	339. VH	37.00	1546. H	35.00	1697. H	38.00	1239. H	36.00	892. VH	37.00
N137	306.	35.00	1363.	14.00	1441.	7.00	1091.	17.00	755.	14.50
MEDIAN CONC.	279.000		1393.000		1531.000		1100.000		771.000	
$\bar{X}$	294.13		1400.58		1528.55		1107.86		772.37	
S	83.05		104.95		108.77		75.32		61.88	
n	38		38		38		38		38	
l	38		38		38		38		38	

Table A-20. Extractable Zinc (pooled data)

SAMPLE	1		2		3		4		5	
LAB NO	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK	REPORTED VALUE	RANK
N002	200. VL	4.00	1080. VL	1.00	1320. L	1.00	940. L	1.00	690. L	3.00
N005	267.	12.00	1410.	13.00	1560.	15.00	1120.	13.00	773.	11.00
N010A	233.	5.00	1234.	4.00	1404.	7.00	1032.	5.00	669. L	1.00
N010D	250.	6.50	1274.	6.00	1379	4.00	1031.	11.00	742	8.00
N013	285.	14.00	1412.	14.00	1468.	9.00	1096.	12.00	787.	14.00
N019C	261.	9.00	1310.	8.00	1410.	8.00	1060.	8.00	720.	5.00
N019D	266.	11.00	1350.	9.50	1500.	10.50	1070.	9.00	731.	7.00
N021	269.	14.00	1350.	9.50	1520.	13.50	1040.	10.00	756.	3.00
N030C	263.	10.00	1535. H	17.00	1670	17.00	1260. VH	16.00	800.	15.50
N030D	267.5	13.00	1385.	11.00	1510	12.00	1130.	14.00	812.	17.00
N034	254.	15.00	1460.	16.00	1610.	16.00	1150. H	15.00	784.	13.00
N047	300. H	17.00	1400.	12.00	1500.	10.50	1300. VH	17.00	700.	4.00
N058A	111. VL	1.00	1140. VL	3.00	1370	3.00	932.	3.00	775.	12.00
N067	250.	6.50	1300.	7.00	1400	6.00	1000.	4.00	730.	9.00
N071	179. VL	2.50	1460.	15.00	1520.	13.50	1050.	7.00	800.	15.50
N093B	170. VL	2.50	1122. VL	2.00	1337. L	2.00	990.	2.00	684. L	2.00
N119	360. VH	18.00	1685. VH	18.00	1820. VH	18.00	1310. VH	18.00	950. VH	18.00
N130C	259	8.00	1240.	5.00	1390	5.00	1030.	5.00	768.	10.00
MEDIAN CONC.	262.000		1350.000		1484.000		1075.000		762.000	
$\bar{x}$	248.08		1340.94		1479.89		1100.06		759.72	
s	56.05		150.03		122.97		115.32		64.07	
n	18		18		18		18		18	
l	18		18		18		18		18	

Appendix B

Tables for Overall Ranking Results for Pooled "Total" and Pooled "Extractable" Data

Table B-1. Aluminum

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N057	6.00	1.200	5	VL VL VL VL VL	BIASED LOW	TOTAL BY AA
N012	9.00	1.800	5	VL VL VL VL VL	BIASED LOW	TOTAL BY AA
N008	18.00	3.600	5	VL VL VL VL VL	BIASED LOW	TOTAL BY AA
N051	19.00	3.800	5	VL VL VL VL VL	BIASED LOW	TOTAL BY ICP
N120R	25.00	5.000	5	VL VL VL VL VL		TOTAL BY ICP (2H)
N073	34.00	6.800	5	VL VL VL VL VL		TOTAL BY AA
N015	34.00	6.800	5	VL VL VL VL VL		TOTAL BY AA
N065	41.00	8.200	5	VL L L VL		TOTAL BY AA
N010	42.00	8.400	5	VL VL L L		TOTAL BY ICP (HF)
N023	52.50	10.500	5	VL		TOTAL BY AA
N019	59.50	11.900	5			TOTAL BY AA
N130R	62.00	12.400	5			TOTAL BY NAA
N130	63.00	13.800	5			TOTAL BY AA-FUSION
N111	73.50	14.700	5			TOTAL BY AA,25G+EA
N058	79.00	15.800	5			TOTAL BY ICP
N120	81.00	16.200	5	VL		TOTAL BY AA (3H)
N102	86.50	17.300	5			TOTAL BY AA-FUSION
N136	88.00	17.600	5			TOTAL BY NAA
N030	101.00	20.200	5			TOTAL BY AA
N057	103.00	20.600	5			TOTAL BY AA
N137	104.00	20.800	5			TOTAL BY INAA
N074R	113.00	22.600	5			TOTAL BY ICP
N076	113.00	22.600	5			TOTAL BY INAA
N057R	115.00	23.000	5			TOTAL BY ICP-OES
N109	125.00	25.000	5			TOTAL BY AA
N109R	126.50	25.700	5			TOTAL BY AA +HCLO4
N062	130.50	26.100	5	H		TOTAL BY AA
N006	134.50	26.900	5			TOTAL BY AA
N019R	141.00	28.200	5			TOTAL BY ICP
N118	142.50	28.500	5			TOTAL BY AA .1G-8A
N074	150.00	30.000	5	H	BIASED HIGH	TOTAL BY AA
N039	160.00	32.000	5	HH	BIASED HIGH	TOTAL BY ICP

OVERALL AVERAGE RANK IS 16.500

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N002	5.00	1.000	5	VL VL VL VL VL	BIASED LOW	EXTRACTABLE BY AA
N058	10.00	2.000	5	VL VL VL VL VL	BIASED LOW	EXTRACTABLE BY ICP
N005	18.00	3.600	5			EXTRACTABLE BY ICP
N010R	23.00	4.600	5			EXTR. BY ICP (AR)
N130C	27.00	5.400	5			EXTRACTABLE BY AA
N019C	28.00	5.600	5			EXTRACTABLE BY AA
N030D	34.00	6.800	5			EXTRACTABLE BY ICP
N013	40.00	8.000	5			EXTRACTABLE BY ICP
N067	41.50	8.300	5			EXTRACTABLE BY ICP
N019D	51.00	10.200	5	H		EXTRACTABLE BY AA
N030C	52.50	10.500	5			EXTRACTABLE BY AA
N034	61.00	12.200	5	V H V H V H H H	BIASED HIGH	EXTRACTABLE BY AA
N119	64.00	12.800	5	V H V H V H V H V H	BIASED HIGH	

OVERALL AVERAGE RANK IS 7.000

Table B-2. Cadmium

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N003	0.00	0.000	0		INSUFFICIENT DATA	TOTAL BY AA (BOMB)
N019A	0.00	0.000	0		INSUFFICIENT DATA	TOTAL BY ICP
N130	0.00	0.000	0		INSUFFICIENT DATA	TOTAL BY AA-FUSION
N060	5.50	1.833	3	LVLL	INSUFFICIENT DATA	TOTAL BY ICP
N120	12.00	3.000	4	LLL	BIASED LOW	TOTAL BY ICP (2H)
N030	16.00	4.000	4	L		TOTAL BY AA (3H)
N030B	22.00	4.400	5	LLL		TOTAL BY ICP
N041	27.50	4.500	6	VLVL		TOTAL BY AA-GF
N102	15.00	5.000	3	L		TOTAL BY AA
N053	34.00	6.800	5			TOTAL BY AA
N030	38.00	7.600	5			TOTAL BY AA
N051A	39.00	7.800	5	L		TOTAL BY AA
N057B	52.50	10.500	5			TOTAL BY ICP-MS
N057	35.50	11.833	3			TOTAL BY AA
N093	61.00	12.200	5	L		TOTAL BY AA
N074B	62.00	12.400	5			TOTAL BY ICP
N062	65.00	13.000	5	LVH		TOTAL BY AA
N073	67.50	13.500	5			TOTAL BY AA
N019	76.00	15.200	5	HH		TOTAL BY AA
N024	77.00	15.400	5	VH		TOTAL BY AA
N089	82.00	16.400	5	HVH		TOTAL BY AA
N012	84.00	16.800	5			TOTAL BY AA
N074	86.00	17.200	5			TOTAL BY AA
N058	87.00	17.667	3			TOTAL BY ICP
N008	89.50	17.900	5	VH		TOTAL BY AA
N027	77.00	19.250	4	VH		TOTAL BY AA
N111	108.00	21.600	5	HHVHVHH		TOTAL BY AA.25G+BA
N010C	115.00	23.000	5	VHVHHVH		TOTAL BY AA-GF(HF)
N111P	115.50	23.100	5	VHVHVH		TOTAL BY AA .1G-BA
N065	117.00	23.400	5	VHVHVHVH		TOTAL BY AA
N006	119.50	23.900	5	VHVHVHVHH	BIASED HIGH	TOTAL BY AA

OVERALL AVERAGE RANK IS 13.554

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N019D	0.00	0.000	0		INSUFFICIENT DATA	EXTRACTABLE BY ICP
N130C	0.00	0.000	0		INSUFFICIENT DATA	EXTRACTABLE BY AA
N071	10.50	2.100	5		BIASED LOW	EXTRACTABLE BY AA
N119	17.00	3.400	5			EXTRACTABLE BY AA
N030C	17.00	3.400	5			EXTRACTABLE BY AA
N005	25.50	5.100	5	L		EXTRACTABLE BY ICP
N067B	28.00	5.600	5			EXTRACTABLE BY AA
N034	29.00	5.800	5			EXTRACTABLE BY AA
N030D	36.00	7.200	5			EXTRACTABLE BY ICP
N017	37.50	7.500	5			EXTRACTABLE BY ICP
N019C	40.00	8.000	5	VHVL		EXTRACTABLE BY AA
N058B	25.50	8.500	3			EXTRACTABLE BY ICP
N021	49.50	9.900	5			EXTRACTABLE BY AA
N002	57.50	10.700	5			EXTRACTABLE BY AA
N093B	61.00	12.200	5	HH		EXTRACTABLE BY AA
N010D	66.00	13.200	5	HVHVHVH	BIASED HIGH	EXTR. BY AA-GF(AR)
N047	73.00	14.600	5	VHVHVHVHVH	BIASED HIGH	EXTRACTABLE BY DCP

OVERALL AVERAGE RANK IS 7.858

Table B-3. Cobalt

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N074	0.00	0.000	0		INSUFFICIENT DATA	TOTAL BY AA
N130	0.00	0.000	0		INSUFFICIENT DATA	TOTAL BY AA-FUSION
N130B	1.00	1.000	1	VL	INSUFFICIENT DATA	TOTAL BY NAA
N120B	10.00	2.000	5	LL	BIASED LOW	TOTAL BY ICP (2H)
N012	17.00	3.400	5	L	BIASED LOW	TOTAL BY AA
N030B	33.00	6.600	5			TOTAL BY ICP
N060	33.50	6.700	5	L		TOTAL BY ICP
N073	34.50	6.900	5			TOTAL BY AA
N120	38.00	7.600	5	LL		TOTAL BY AA (3H)
N109	39.50	7.900	5			TOTAL BY AA
N057	45.50	9.100	5			TOTAL BY AA
N075	48.00	9.600	5			TOTAL BY INAA
N003	10.00	10.000	1		INSUFFICIENT DATA	TOTAL BY AA (BOMB)
N109B	54.00	10.800	5			TOTAL BY AA +HCLO4
N057B	58.50	11.700	5	L		TOTAL BY ICP-OES
N136	65.50	13.100	5			TOTAL BY NAA
N102	66.00	13.200	5			TOTAL BY AA
N030	66.00	13.200	5			TOTAL BY AA
N051	73.00	14.600	5			TOTAL BY ICP
N137	75.00	15.000	5			TOTAL BY INAA
N058	79.00	15.800	5			TOTAL BY ICP
N019	87.00	16.900	5			TOTAL BY AA
N024	91.00	18.200	5			TOTAL BY AA
N019B	95.00	19.000	5			TOTAL BY ICP
N074B	103.00	20.600	5			TOTAL BY ICP
N010	107.00	21.400	5			TOTAL BY ICP (HF)
N062	112.00	22.400	5			TOTAL BY AA
N008	121.00	24.200	5			TOTAL BY AA
N0A9	122.00	24.400	5	H		TOTAL BY AA
N111	132.00	26.600	5	VHVHHH		TOTAL BY AA.25G+BA
N023	137.00	27.400	5	HVHVHVHVH		TOTAL BY AA
N006	141.00	28.200	5	VHVHVHVHVH		TOTAL BY AA
N065	145.00	29.000	5	VHVHVHVHH	BIASED HIGH	TOTAL BY AA
N067	151.00	30.600	5	VHVHVHVHVH	BIASED HIGH	TOTAL BY AA
N111B	156.00	31.200	5	VHVHVHVHVH	BIASED HIGH	TOTAL BY AA .1G-BA
OVERALL AVERAGE RANK IS		16.210				

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N058B	5.00	1.000	5	VLLLLVL	BIASED LOW	EXTRACTABLE BY ICP
N071	20.00	4.000	5			EXTRACTABLE BY AA
N130C	21.00	4.200	5			EXTRACTABLE BY AA
N010B	23.00	4.600	5			EXTR. BY ICP (AR)
N034	25.00	5.000	5			EXTRACTABLE BY AA
N019C	30.00	6.000	5			EXTRACTABLE BY AA
N013	31.00	6.200	5			EXTRACTABLE BY ICP
N010D	41.00	8.200	5			EXTRACTABLE BY ICP
N030C	42.50	8.500	5			EXTRACTABLE BY AA
N030D	47.00	9.400	5			EXTRACTABLE BY ICP
N067	51.50	10.300	5			EXTRACTABLE BY ICP
N119	55.50	11.900	5	H		EXTRACTABLE BY AA
N047	59.50	11.900	5			EXTRACTABLE BY DCP
N005	64.00	13.800	5	HH	BIASED HIGH	EXTRACTABLE BY ICP
OVERALL AVERAGE RANK IS		7.500				

Table B-4. Copper

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N053	8.00	1.600	5	VLVLVLVLVL	BIASED LOW	TOTAL BY AA
N012	12.00	2.400	5	LLVLL	BIASED LOW	TOTAL BY AA
N076B	21.50	4.300	5	LLL	BIASED LOW	TOTAL BY ICP
N109	28.50	5.700	5	LL		TOTAL BY AA
N073	42.50	8.500	5			TOTAL BY AA
N120B	45.50	9.100	5			TOTAL BY ICP (2H)
N051	48.50	9.700	5			TOTAL BY ICP
N019B	54.50	10.900	5	LVH		TOTAL BY ICP
N041	62.50	12.500	5	VLVL		TOTAL BY AA
N060	68.00	13.600	5			TOTAL BY ICP
N030	72.00	14.400	5			TOTAL BY AA
N057	75.50	15.100	5			TOTAL BY AA
N008A	78.00	15.600	5	VH		TOTAL BY AA
N062	80.50	16.100	5			TOTAL BY AA
N006	81.00	16.200	5			TOTAL BY AA
N109D	83.00	16.600	5			TOTAL BY AA +HCLO4
N057A	84.50	16.900	5	L		TOTAL BY ICP-OES
N023	87.00	17.400	5	VH		TOTAL BY AA
N074	91.00	18.200	5	H		TOTAL BY AA
N019	98.00	19.600	5	VH		TOTAL BY AA
N058	98.50	19.700	5			TOTAL BY ICP
N111	104.00	20.800	5			TOTAL BY AA,25G+8A
N084	107.00	21.400	5	H		TOTAL BY AA
N065	107.50	21.500	5	VL		TOTAL BY AA
N093	112.00	22.400	5			TOTAL BY AA
N111B	126.00	25.200	5			TOTAL BY AA .1G-8A
N107	127.50	25.500	5			TOTAL BY AA
N015	127.50	25.500	5			TOTAL BY AA
N003	128.00	25.600	5	H		TOTAL BY AA (8CH8I
N130	131.00	26.200	5			TOTAL BY AA
N120	131.50	26.300	5			TOTAL BY AA (3H)
N010C	132.00	26.400	5			TOTAL BY AA (HF)
N024	151.50	30.300	5	HH		TOTAL BY AA
N136	32.00	32.000	1		INSUFFICIENT DATA	TOTAL BY NAA
N030D	168.00	33.600	5	VHVHVHVHH	BIASED HIGH	TOTAL BY ICP

OVERALL AVERAGE RANK IS 17.602

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N058B	6.00	1.200	5	VLVLVLVLVL	BIASED LOW	EXTRACTABLE BY ICP
N093B	10.00	2.000	5	VLVLVLVLL	BIASED LOW	EXTRACTABLE BY AA
N002	14.00	2.800	5	VLVLVLLL	BIASED LOW	EXTRACTABLE BY AA
N019D	22.00	4.400	5	LLL		EXTRACTABLE BY ICP
N021	35.50	7.100	5			EXTRACTABLE BY AA
N030D	36.00	7.200	5			EXTRACTABLE BY ICP
N019C	41.50	8.300	5			EXTRACTABLE BY AA
N119	48.50	9.700	5	VH		EXTRACTABLE BY AA
N005	50.00	10.000	5			EXTRACTABLE BY ICP
N067	51.50	10.300	5			EXTRACTABLE BY ICP
N010D	54.00	10.800	5	L		EXTR. BY AA (AR)
N034	54.00	10.800	5			EXTRACTABLE BY AA
N030C	59.00	11.800	5			EXTRACTABLE BY AA
N047	63.00	12.600	5	HL		EXTRACTABLE BY OCP
N071	66.50	13.300	5			EXTRACTABLE BY AA
N130C	68.50	13.700	5			EXTRACTABLE BY AA
N013	85.00	17.000	5	VHVHHVHVH	BIASED HIGH	EXTRACTABLE BY ICP

OVERALL AVERAGE RANK IS 9.000

Table B-5. Iron

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N012	6.00	1.200	5	VLVLVLVLVL	BIASED LOW	TOTAL BY AA
N008	13.00	2.600	5	VLVLVLVLVL	BIASED LOW	TOTAL BY AA
N010	25.00	5.000	5	VLVLL		TOTAL BY ICP (HF)
N065	26.00	5.200	5	VLVLLVL		TOTAL BY AA
N051	37.50	7.500	5	LVLL		TOTAL BY ICP
N074B	40.50	8.100	5	LL		TOTAL BY ICP
N073	42.00	8.400	5	L		TOTAL BY AA
N076	44.00	8.800	5			TOTAL BY INAA
N089	49.50	9.900	5	VLL		TOTAL BY AA
N120B	54.50	10.900	5	L		TOTAL BY ICP (2H)
N041	56.00	11.200	5			TOTAL BY AA
N053	69.00	13.800	5	LL		TOTAL BY AA
N093	70.00	14.000	5			TOTAL BY AA
N111	74.00	14.800	5			TOTAL BY AA.25G+BA
N109	74.50	14.900	5			TOTAL BY AA
N023	77.00	15.400	5	VLVH		TOTAL BY AA
N030	79.00	15.800	5			TOTAL BY AA
N109A	87.50	16.700	5			TOTAL BY AA +HCLO4
N086	93.00	18.600	5			TOTAL BY AA
N062	103.50	20.700	5			TOTAL BY AA
N003	104.00	20.800	5			TOTAL BY AA (BOMB)
N137	110.50	22.100	5			TOTAL BY INAA
N074	113.00	22.600	5			TOTAL BY AA
N060	120.50	24.100	5			TOTAL BY ICP
N102B	124.00	24.800	5			TOTAL BY FUSN-TITR
N015	125.00	25.200	5			TOTAL BY AA
N057B	130.00	26.000	5			TOTAL BY ICP-OES
N130	136.50	27.300	5			TOTAL BY AA-FUSION
N120	142.50	28.500	5			TOTAL BY AA (3H)
N136	144.00	28.800	5			TOTAL BY INAA
N030A	149.00	29.800	5			TOTAL BY ICP
N111A	150.00	30.000	5			TOTAL BY AA .1G-BA
N019	158.00	31.600	5	H		TOTAL BY AA
N024	161.50	32.300	5	H	BIASED HIGH	TOTAL BY AA
N058	164.00	32.800	5		BIASED HIGH	TOTAL BY ICP
N019A	173.00	34.600	5	HH	BIASED HIGH	TOTAL BY ICP
OVERALL AVERAGE RANK IS		18.500				

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N002	8.00	1.600	5	VLVLVLVLVL	BIASED LOW	EXTRACTABLE BY AA
N058A	8.00	1.600	5	VLVLVLVLVL	BIASED LOW	EXTRACTABLE BY ICP
N093	14.00	2.800	5	VLVLVLVLVL	BIASED LOW	EXTRACTABLE BY AA
N071	20.00	4.000	5	VLVLLLL		EXTRACTABLE BY AA
N010B	26.50	5.300	5	L		EXTR. BY ICP (AR)
N067	39.50	7.900	5			EXTRACTABLE BY ICP
N019C	40.00	8.000	5			EXTRACTABLE BY AA
N013	40.50	8.100	5			EXTRACTABLE BY ICP
N005	40.50	8.100	5			EXTRACTABLE BY ICP
N021	50.00	10.000	5	H		EXTRACTABLE BY AA
N019D	57.00	11.400	5			EXTRACTABLE BY ICP
N030C	60.00	12.000	5	H		EXTRACTABLE BY AA
N034	66.50	13.300	5			EXTRACTABLE BY AA
N119	72.00	14.400	5	HH		EXTRACTABLE BY AA
N047	72.50	14.500	5	VH		EXTRACTABLE BY DCP
N130C	72.50	14.500	5	H		EXTRACTABLE BY AA
N030D	77.50	15.500	5	HH	BIASED HIGH	EXTRACTABLE BY ICP
OVERALL AVERAGE RANK IS		9.000				

Table B-6. Manganese

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N012	10.00	2.000	5	VLVLVLVL	BIASED LOW	TOTAL BY AA
N120	24.50	4.900	5	LVLL		TOTAL BY ICP (2H)
N074A	32.00	6.400	5	LVLL		TOTAL BY ICP
N010	36.00	7.200	5	VLVLLL		TOTAL BY ICP (HF)
N093	46.50	9.300	5	VLL		TOTAL BY AA
N0A9	47.00	9.400	5	LVLVL		TOTAL BY AA
N130A	50.50	10.100	5			TOTAL BY NAA
N030B	53.00	10.600	5	L		TOTAL BY ICP
N073	57.50	11.500	5	L		TOTAL BY AA
N074	58.00	11.600	5			TOTAL BY AA
N065	66.00	13.000	5			TOTAL BY AA
N057	67.00	13.400	5	VLVLL		TOTAL BY AA
N057A	74.50	14.900	5	VLL		TOTAL BY ICP-OES
N051	77.50	15.500	5	L		TOTAL BY ICP
N008	82.50	16.500	5			TOTAL BY AA
N023	83.50	16.700	5	VL		TOTAL BY AA
N111	86.00	17.000	5			TOTAL BY AA.25G+BA
N109A	87.00	17.400	5			TOTAL BY AA +HCLO4
N019	91.50	18.300	5			TOTAL BY AA
N030	93.50	18.700	5			TOTAL BY AA
N058	94.00	18.800	5			TOTAL BY ICP
N076	94.00	18.800	5			TOTAL BY INAA
N109	95.00	19.000	5			TOTAL BY AA
N019A	98.50	19.700	5			TOTAL BY ICP
N053	103.50	20.700	5			TOTAL BY AA
N006	125.00	25.000	5			TOTAL BY AA
N130	127.00	25.400	5			TOTAL BY AA-FUSION
N062	129.00	25.800	5			TOTAL BY AA
N015	134.50	26.900	5			TOTAL BY AA
N107	139.00	27.800	5	HH		TOTAL BY AA
N120	145.00	29.000	5	HHVH		TOTAL BY AA (3H)
N111B	149.00	29.800	5	HVH		TOTAL BY AA .1G-BA
N137	153.50	30.700	5	HH		TOTAL BY INAA
N136	166.00	33.200	5	HHHVH	BIASED HIGH	TOTAL BY NAA
					BIASED HIGH	

OVERALL AVERAGE RANK IS 17.500

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N058A	6.00	1.200	5	LVLVLVLVL	BIASED LOW	EXTRACTABLE BY ICP
N071	12.50	2.500	5	VLVLVLVL	BIASED LOW	EXTRACTABLE BY AA
N091A	15.00	3.000	5	LVLVLVL		EXTRACTABLE BY AA
N002	24.00	4.800	5	LVLVL		EXTRACTABLE BY AA
N010A	31.00	6.200	5			EXTR. BY ICP (AS)
N067	31.00	6.200	5			EXTRACTABLE BY ICP
N119	33.00	6.600	5	L		EXTRACTABLE BY AA
N085	37.00	7.400	5			EXTRACTABLE BY ICP
N021	42.50	8.500	5			EXTRACTABLE BY AA
N019A	52.50	10.500	5			EXTRACTABLE BY ICP
N013	58.00	11.600	5			EXTRACTABLE BY ICP
N030D	60.00	12.000	5	H		EXTRACTABLE BY ICP
N019C	63.00	12.600	5			EXTRACTABLE BY AA
N034	71.00	14.200	5	HHHH		EXTRACTABLE BY AA
N030C	71.00	14.200	5	VHHHVH		EXTRACTABLE BY AA
N130C	72.50	14.500	5	VHHHVH	BIASED HIGH	EXTRACTABLE BY AA

OVERALL AVERAGE RANK IS 8.500

Table B-7. Nickel

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N015	12.00	2.400	5	VLLVLVL	BIASED LOW	TOTAL BY AA
N137	3.00	3.000	1	VL	INSUFFICIENT DATA	TOTAL BY INNA
N053	17.00	3.400	5	LVL	BIASED LOW	TOTAL BY AA
N012	18.00	3.600	5	VL	BIASED LOW	TOTAL BY AA
N019	25.00	5.000	5	L		TOTAL BY AA
N120B	32.00	6.400	5			TOTAL BY ICP (2H)
N003	38.00	7.600	5	LVLVL		TOTAL BY AA (BOMB)
N057	44.00	11.000	4			TOTAL BY AA
N074A	56.50	11.300	5			TOTAL BY ICP
N102	57.50	11.900	5			TOTAL BY AA
N030B	64.50	12.900	5			TOTAL BY ICP
N062	66.00	13.200	5	H		TOTAL BY AA
N076	29.00	14.500	2		INSUFFICIENT DATA	TOTAL BY INAA
N051	73.50	14.700	5			TOTAL BY ICP
N018B	78.00	15.600	5			TOTAL BY ICP
N073	78.50	15.700	5			TOTAL BY AA
N030	80.00	16.000	5			TOTAL BY AA
N010	80.00	16.000	5			TOTAL BY ICP (HF)
N058C	81.00	16.200	5			TOTAL BY AA
N120	85.00	17.200	5			TOTAL BY AA (3H)
N089	87.50	17.500	5			TOTAL BY AA
N060	90.00	18.000	5			TOTAL BY ICP
N057B	99.00	19.800	5	H		TOTAL BY ICP-OES
N008A	114.50	22.900	5			TOTAL BY AA
N109	115.50	23.100	5			TOTAL BY AA
N111	116.00	23.200	5	VHHVHVH		TOTAL BY AA.25G+BA
N023	118.00	23.600	5	VHHH		TOTAL BY AA
N109B	121.50	24.300	5	HH		TOTAL BY AA +HCLO4
N066	123.00	24.600	5	VHVHVH		TOTAL BY AA
N130	131.00	26.200	5	VHVHH		TOTAL BY AA-FUSION
N024	135.00	27.000	5	HHVH		TOTAL BY AA
N041	135.00	27.000	5	VHHVHVH		TOTAL BY AA
N074	28.50	28.500	1		INSUFFICIENT DATA	TOTAL BY AA
N006	152.00	30.400	5	VHVHVHVHH	BIASED HIGH	TOTAL BY AA
N111B	152.00	30.400	5	VHVHVHVH	BIASED HIGH	TOTAL BY AA .1G-BA
N136	35.00	35.000	1	VH	INSUFFICIENT DATA	TOTAL BY NAA

OVERALL AVERAGE RANK IS 16.921

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N058B	5.00	1.000	5	VLVLVLVLVL	BIASED LOW	EXTRACTABLE BY ICP
N002	11.00	2.200	5	LVLVLVL	BIASED LOW	EXTRACTABLE BY AA
N019C	19.00	3.800	5			EXTRACTABLE BY AA
N067	24.00	4.800	5			EXTRACTABLE BY ICP
N013	29.00	5.800	5			EXTRACTABLE BY ICP
N071	31.00	6.200	5			EXTRACTABLE BY AA
N010B	33.00	6.600	5			EXTR. BY ICP (AR)
N019D	36.00	7.200	5			EXTRACTABLE BY ICP
N021	43.50	8.700	5			EXTRACTABLE BY AA
N034	54.50	10.900	5	H		EXTRACTABLE BY AA
N030D	55.50	11.100	5	H		EXTRACTABLE BY ICP
N005	59.50	11.900	5			EXTRACTABLE BY ICP
N047	63.50	12.700	5	H		EXTRACTABLE BY DCP
N030C	66.00	13.000	5	H		EXTRACTABLE BY AA
N130C	73.00	15.000	5	HH	BIASED HIGH	EXTRACTABLE BY AA
N119	75.50	15.100	5	HHH	BIASED HIGH	EXTRACTABLE BY AA

OVERALL AVERAGE RANK IS 9.500

Table B-8. Lead

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N012	17.00	3.400	5	LLL	BIASED LOW	TOTAL BY AA
N023	19.00	3.800	5	VLVLVL	BIASED LOW	TOTAL BY AA
N010C	19.50	3.900	5	LVLVL	BIASED LOW	TOTAL BY AA (HF)
N120B	28.50	5.700	5			TOTAL BY ICP (2H)
N030	34.50	6.900	5			TOTAL BY AA
N057	36.00	7.200	5	L		TOTAL BY AA
N120	41.50	8.300	5	L		TOTAL BY AA (3H)
N053	45.00	9.000	5	LL		TOTAL BY AA
N074A	48.00	9.600	5			TOTAL BY ICP
N111	50.50	10.100	5			TOTAL BY AA.25G+BA
N062	61.50	12.300	5			TOTAL BY AA
N077	66.50	13.300	5			TOTAL BY AA
N074	68.00	13.600	5			TOTAL BY AA
N109	72.50	14.500	5			TOTAL BY AA
N057B	73.50	14.700	5	L		TOTAL BY ICP-MS
N051A	77.50	15.500	5			TOTAL BY AA
N102	81.50	16.300	5			TOTAL BY AA
N030B	90.00	18.000	5			TOTAL BY ICP
N060B	97.00	19.400	5			TOTAL BY AA
N109B	97.50	19.500	5			TOTAL BY AA +MCLCK
N022	102.00	20.400	5			TOTAL BY AA
N089	104.00	20.800	5	VH		TOTAL BY AA
N130	106.00	21.200	5			TOTAL BY AA-FUSION
N003	111.00	22.200	5	VH		TOTAL BY AA (BCPB)
N008	118.00	23.600	5	H		TOTAL BY AA
N041	119.00	23.800	5	VHVHVHVHVL		TOTAL BY AA-GF
N019B	130.50	26.100	5	VHHVH		TOTAL BY ICP
N08E	132.00	26.400	5	VHHH		TOTAL BY AA
N09?	137.50	27.500	5	VHHVH		TOTAL BY AA
N05A	140.00	28.000	5	VHHVH		TOTAL BY ICP
N111A	164.00	30.800	5	VHVHVHVHVH	BIASED HIGH	TOTAL BY AA .1G-BA
N065	160.00	32.000	5	VHVHLHVHVH	BIASED HIGH	TOTAL BY AA

OVERALL AVERAGE RANK IS 16.600

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N05AB	5.00	1.000	5	VLVLVLVLVL	BIASED LOW	EXTRACTABLE BY ICP
N010D	18.50	3.700	5			EXTR. BY AA (AP)
N071	23.00	4.600	5			EXTRACTABLE BY AA
N067	23.50	4.700	5	LL		EXTRACTABLE BY ICP
N002	27.00	5.200	5	L		EXTRACTABLE BY AA
N093A	26.00	5.200	5	VL		EXTRACTABLE BY AA
N030C	31.50	6.300	5			EXTRACTABLE BY AA
N034	33.50	6.700	5			EXTRACTABLE BY AA
N021	44.50	8.900	5			EXTRACTABLE BY AA
N030D	50.00	10.000	5			EXTRACTABLE BY ICP
N119B	55.00	11.000	5	H		EXTRACTABLE BY ICP
N005	62.00	12.400	5	H		EXTRACTABLE BY ICP
N130C	61.00	12.200	5	H		EXTRACTABLE BY AA
N013	64.00	12.800	5	HVH		EXTRACTABLE BY ICP
N119	77.00	15.400	5	VHVHHVHVH	BIASED HIGH	EXTRACTABLE BY AA
N047	77.50	15.500	5	HVHVHVHH	BIASED HIGH	EXTRACTABLE BY DCP

OVERALL AVERAGE RANK IS 8.600

Table B-9. Vanadium

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N012	8.00	1.600	5	VLVLVLVLVL	BIASED LOW	TOTAL BY AA
N051	11.00	2.200	5	VLVLVLVLVL	BIASED LOW	TOTAL BY ICP
N120A	31.00	6.200	5			TOTAL BY ICP (2H)
N076	32.00	6.400	5	VL		TOTAL BY INAA
N030A	32.00	6.400	5			TOTAL BY ICP
N074B	34.50	6.900	5			TOTAL BY ICP
N073	38.00	7.600	5	VL		TOTAL BY AA
N058	38.50	7.700	5			TOTAL BY ICP
N130A	38.50	7.700	5			TOTAL BY NAA
N120	41.00	8.200	5			TOTAL BY AA (3H)
N065	52.00	10.400	5			TOTAL BY AA
N136	60.00	12.000	5			TOTAL BY NAA
N137	60.50	12.100	5			TOTAL BY INAA
N010	68.00	13.600	5			TOTAL BY ICP (HF)
N057A	69.00	13.800	5			TOTAL BY ICP-OES
N053	70.50	14.100	5	VH		TOTAL BY AA
N030	87.50	17.900	5	HHH		TOTAL BY AA
N086	90.00	18.000	5	HHVH		TOTAL BY AA
N019A	94.00	19.600	5	VHHVHVHH		TOTAL BY ICP
N019	99.00	19.800	5	HVHVHVH	BIASED HIGH	TOTAL BY AA
N023	101.00	20.200	5	HVHVHHVH	BIASED HIGH	TOTAL BY AA
N015	103.00	20.600	5	VHVHVHVH	BIASED HIGH	TOTAL BY AA

OVERALL AVERAGE RANK IS 11.500

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N058A	5.00	1.000	5	VLVLVLVLVL	BIASED LOW	EXTRACTABLE BY ICP
N005	10.00	2.000	5	LLL	BIASED LOW	EXTRACTABLE BY ICP
N030D	16.00	3.200	5			EXTRACTABLE BY ICP
N067	23.00	4.600	5			EXTRACTABLE BY ICP
N010A	26.00	5.200	5			EXTR. BY ICP (AR)
N019D	30.00	6.000	5			EXTRACTABLE BY ICP
N013	31.00	6.200	5			EXTRACTABLE BY ICP
N019C	42.00	8.400	5	VHH		EXTRACTABLE BY AA
N119	45.00	9.000	5	HVHH	BIASED HIGH	EXTRACTABLE BY AA
N030C	47.00	9.400	5	HVHVHH	BIASED HIGH	EXTRACTABLE BY AA

OVERALL AVERAGE RANK IS 5.500

Table B-10. Zinc

Pooled "Total" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N065	20.00	4.000	5	LVL		TOTAL BY AA
N019	22.00	4.400	5	LLL	BIASED LOW	TOTAL BY AA
N093	24.00	4.800	5	LL	BIASED LOW	TOTAL BY AA
N012	27.00	5.400	5	LLVL		TOTAL BY AA
N010	35.00	7.000	5	VLLL		TOTAL BY ICP (HF)
N074B	41.50	8.300	5			TOTAL BY ICP
N010C	46.00	9.200	5	VLVL		TOTAL BY AA (HF)
N003	55.50	11.100	5			TOTAL BY AA (DCMA)
N057	58.50	11.700	5			TOTAL BY AA
N174	61.50	12.300	5			TOTAL BY AA
N111	63.00	12.600	5			TOTAL BY AA. 25G+8A
N111A	75.50	15.100	5			TOTAL BY AA .1G-8A
N089	77.50	15.500	5	VH		TOTAL BY AA
N109	78.00	15.600	5			TOTAL BY AA
N060	81.00	16.200	5			TOTAL BY ICP
N137	87.50	17.500	5			TOTAL BY INAA
N062	92.50	18.500	5			TOTAL BY AA
N019A	97.50	19.500	5			TOTAL BY ICP
N041	100.50	20.100	5	VH		TOTAL BY AA
N120A	104.50	20.900	5			TOTAL BY ICP (ZN)
N102	115.50	23.100	5			TOTAL BY AA
N030B	117.50	23.500	5			TOTAL BY ICP
N044	120.00	24.000	5			TOTAL BY AA
N109A	121.00	24.200	5			TOTAL BY AA +HCLO4
N030	122.50	24.500	5			TOTAL BY AA
N051	126.00	25.200	5			TOTAL BY ICP
N023	128.50	25.700	5	VHVH		TOTAL BY AA
N006	131.50	26.300	5			TOTAL BY AA
N058	132.50	26.500	5	H		TOTAL BY ICP
N024	133.00	26.600	5			TOTAL BY AA
N130	138.50	27.700	5			TOTAL BY AA-FUSION
N057A	139.50	27.900	5			TOTAL BY ICP-OES
N074	141.50	28.300	5	H		TOTAL BY AA
N120	142.00	28.400	5	H		TOTAL BY AA (3M)
N008	145.50	29.100	5	HHVHH		TOTAL BY AA
N058C	146.50	29.300	5			TOTAL BY AA
N015	174.00	34.800	5	HH	BIASED HIGH	TOTAL BY AA
N13E	193.00	38.600	5	VHHHHVH	BIASED HIGH	TOTAL BY NAA
OVERALL AVERAGE RANK IS		19.500				

Pooled "Extractable" Data

LAB NO.	TOTAL RANK	AVERAGE RANK	NO. OF SAMPLES RANKED	SUMMARY OF FLAGGING		METHOD CODING
N002	10.00	2.000	5	VLVLLLL	BIASED LOW	EXTRACTABLE BY AA
N093B	10.50	2.100	5	VLVLLL	BIASED LOW	EXTRACTABLE BY AA
N058B	23.00	4.600	5	VLVL		EXTRACTABLE BY ICP
N010B	23.00	4.600	5	L		EXTR. BY ICP (AP)
N067	28.50	5.900	5			EXTRACTABLE BY ICP
N130C	32.00	6.600	5			EXTRACTABLE BY AA
N010D	35.50	7.100	5			EXTR. BY AA (AP)
N019C	38.00	7.600	5			EXTRACTABLE BY AA
N190	42.00	8.400	5			EXTRACTABLE BY ICP
N071	52.50	10.700	5	VL		EXTRACTABLE BY AA
N021	56.00	11.200	5			EXTRACTABLE BY AA
N047	60.50	12.100	5	HVH		EXTRACTABLE BY OCP
N005	64.00	12.800	5			EXTRACTABLE BY ICP
N013	65.00	13.000	5			EXTRACTABLE BY ICP
N030D	67.00	13.400	5			EXTRACTABLE BY ICP
N034	75.00	15.000	5	H		EXTRACTABLE BY AA
N030C	75.50	15.100	5	HVH		EXTRACTABLE BY AA
N119	90.00	18.000	5	VHVHVHVHVH	BIASED HIGH	EXTRACTABLE BY AA
OVERALL AVERAGE RANK IS		9.600				

Appendix C
Median Results

Table C-1. Median Results for Aluminum (%)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	8.29	5.79	5.89	5.71	6.08	20
ICP	8.31	5.89	6.04	6.18	6.37	8
INAA	8.23	5.89	6.22	5.99	6.44	4
Pooled	8.29	5.80	6.04	5.94	6.22	32
			"Extractable" data			
AA*	2.92	1.71	2.02	1.59	1.78	6
ICP	2.57	1.61	1.90	1.60	1.74	7
Pooled	2.61	1.61	1.90	1.60	1.74	13

*AA = Atomic absorption methodology including use of graphite.

Table C-2. Median Results for Cadmium (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used	No. labs reporting
				"Total" data			
AA*	2.10	3.95	5.75	4.40	2.55	18	24
ICP	1.80	3.03	4.60	3.15	1.70	3	7
Pooled	2.10	3.85	5.30	3.80	2.30	21	31
				"Extractable" data			
AA*	1.55	3.45	4.35	3.40	1.70	10	11
ICP	1.53	3.53	4.75	3.58	1.40	3	5
DCP	10.0	17.0	14.0	12.0	8.5	1	1
Pooled	1.60	3.65	4.70	3.55	1.50	14	17

*AA = Atomic absorption methodology including use of graphite.

Table C-3. Median Results for Cobalt (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	20.6	18.2	15.4	15.2	49.6	20
ICP	17.2	13.8	16.0	14.0	45.0	9
INAA	18.0	14.0	13.2	11.7	44.3	3
Pooled	18.2	14.8	15.2	13.0	44.8	32
			"Extractable" data			
AA*	16.0	13.7	13.0	10.8	42.3	6
ICP	18.4	14.0	14.5	14.1	39.5	7
DCP	20.0	19.0	19.0	16.0	46.0	1
Pooled	17.8	14.0	14.3	12.9	42.3	14

*AA = Atomic absorption methodology including use of graphite.

Table C-4. Median Results for Copper (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	80.5	83.8	105.0	81.6	566.0	26
ICP	76.3	82.0	101.0	75.0	555.0	8
INAA	<400	<400	<400	<400	620	1
Pooled	80.0	83.4	105.0	81.0	565.0	35
			"Extractable" data			
AA*	79.0	80.0	102.5	79.0	562.5	10
ICP	75.7	77.8	100.3	79.3	567.0	6
DCP	80.0	90.0	110.0	85.0	500.0	1
Pooled	78.0	80.0	102.0	79.5	564.0	17

*AA = Atomic absorption methodology including use of graphite.

Table C-5. Median Results for Iron (%)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	4.90	5.94	3.60	3.18	3.36	23
ICP	5.10	6.06	3.70	2.96	3.50	9
INAA (3) and Titration (1)	4.99	6.19	3.65	3.32	3.52	4
Pooled	4.92	5.99	3.61	3.19	3.40	36
			"Extractable" data			
AA*	4.42	4.65	2.86	2.38	2.98	9
ICP	4.14	4.70	2.89	2.30	2.65	7
DCP	4.60	5.90	3.40	2.70	3.00	1
Pooled	4.28	4.70	2.89	2.30	2.69	17

*AA = Atomic absorption methodology including use of graphite.

Table C-6. Median Results for Manganese (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	2265.0	1230.0	592.0	543.0	580.5	22
ICP	2147.5	1095.0	551.3	492.5	582.5	8
INAA	2321.5	1276.0	612.0	572.5	607.0	4
Pooled	2260.0	1216.0	586.0	540.5	582.5	34
			"Extractable" data			
AA*	2200.0	1100.0	511.0	418.0	483.0	9
ICP	2280.0	1090.0	480.0	415.0	490.0	7
Pooled	2210.0	1095.0	495.0	415.5	486.5	16

*AA = Atomic absorption methodology including use of graphite.

Table C-7. Median Results for Nickel (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	63.1	56.1	46.0	39.7	949.5	24
ICP	58.7	52.1	42.0	37.2	937.5	8
INAA	58.0†	<45	<45	<40	940.0	3
	<100	<100	<100	<100		
Pooled	59.3	54.4	44.2	38.5	941.0	35
			"Extractable" data			
AA*	57.8	49.5	40.3	33.8	920.5	8
ICP	54.0	47.1	38.8	30.0	850.0	7
DCP	64.0	59.0	50.0	42.0	810.0	1
Pooled	57.6	48.0	40.3	33.0	866.0	16

*AA = Atomic absorption methodology including use of graphite.
†Lab 76.

Table C-8. Median Results for Lead (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	85.7	243.0	257.0	142.5	56.0	26
ICP	88.3	242.8	246.8	145.0	64.3	6
Pooled	85.7	243.0	254.5	143.5	58.0	32
			"Extractable" data			
AA*	75.0	228.0	240.0	133.0	46.0	9
ICP	87.5	237.3	257.0	141.0	55.0	6
DCP	100.0	290.0	310.0	180.0	70.0	1
Pooled	77.0	233.5	250.5	137.5	50.9	16

*AA = Atomic absorption methodology including use of graphite.

Table C-9. Median Results for Vanadium (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	138.00	98.35	100.50	85.50	78.25	10
ICP	120.75	83.10	79.20	69.50	68.30	8
INAA	124.0	85.0	83.5	73.35	63.0	4
Pooled	125.0	88.85	85.50	73.35	69.90	22
			"Extractable" data			
AA*	73.00	54.00	63.30	55.00	59.00	3
ICP	45.00	38.00	42.00	33.20	41.00	7
Pooled	55.00	41.55	43.95	35.70	43.50	10

*AA = Atomic absorption methodology including use of graphite.

Table C-10. Median Results for Zinc (μg/g)

Method	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	No. results used
			"Total" data			
AA*	275.0	1400.0	1520.0	1093.0	767.0	27
ICP	280.0	1380.0	1550.0	1110.0	775.0	9
INAA	322.5	1454.5	1569.0	1165.0	823.5	2
Pooled	279.0	1393.0	1531.0	1100.0	771.0	38
			"Extractable" data			
AA*	260.0	1330.0	1465.0	1070.0	762.0	10
ICP	266.0	1350.0	1468.0	1070.0	773.0	7
DCP	300.0	1400.0	1500.0	1300.0	700.0	1
Pooled	262.0	1350.0	1484.0	1075.0	762.0	18

*AA = Atomic absorption methodology including use of graphite.

Appendix D
Summary of Laboratory Appraisals

Table D-1. Lab 2 (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	Biased low
Cadmium	5	0	Satisfactory
Cobalt	0		
Copper	5	3 VL 2 L	Biased low
Iron	5	5 VL	Biased low
Manganese	5	2 VL 1 L	–
Nickel	5	3 VL 1 L	Biased low
Lead	5	1 L	Satisfactory
Vanadium	0		
Zinc	5	2 VL 3 L	Biased low

Table D-2. Lab 3 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5 (5 less than)	–	Insufficient data
Cobalt	5 (4 less than)	–	Insufficient data
Copper	5	1 H	Satisfactory
Iron	5	0	Satisfactory
Manganese	0		
Nickel	5	2 VL 1 L	–
Lead	5	1 VH	–
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-3. Lab 5 (ICP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	1 L	Satisfactory
Cobalt	5	2 H	Biased high
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	1 H	Satisfactory
Vanadium	5	3 L	Biased low
Zinc	5	0	Satisfactory

Table D-4. Lab 6 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	1 H 4 VH	Biased high
Cobalt	5	5 VH	–
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	1 H 4 VH	Biased high
Lead	5	2 H 1 VH	–
Vanadium (colorimetry)	5	3 L 1 VH	–
Zinc	5	0	Satisfactory

Table D-5. Lab 8 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	Biased low
Cadmium	5	1 VH	–
Cobalt	5	0	Satisfactory
Copper	5	1 VH	–
Iron	5	5 VL	Biased low
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	1 H	Satisfactory
Vanadium	0		
Zinc	5	3 H 1 VH	–

Table D-6. Lab 10 (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	2 VL 2 L	–
Cadmium	0		
Cobalt	5	0	Satisfactory
Copper	0		
Iron	5	2 VL 1 L	–
Manganese	5	2 VL 2 L	–
Nickel	5	0	Satisfactory
Lead	0		
Vanadium	5	0	Satisfactory
Zinc	5	1 VL 2 L	–

Table D-7. Lab 10B (ICP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	0		
Cobalt	5	0	Satisfactory
Copper	0		
Iron	5	1 L	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	0		
Vanadium	5	0	Satisfactory
Zinc	5	1 L	Satisfactory

Table D-8. Lab 10C (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	1 H	–
(graphite)		3 VH	
Cobalt	0		
Copper	5	0	Satisfactory
Iron	0		
Manganese	0		
Nickel	0		
Lead	5	2 VL	Biased low
		1 L	
Vanadium	0		
Zinc	5	2 VL	–

Table D-9. Lab 10D (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	1 H	Biased high
		3 VH	
Cobalt	0		
Copper	5	1 L	Satisfactory
Iron	0		
Manganese	0		
Nickel	0		
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-10. Lab 12 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	Biased low
Cadmium	5	0	Satisfactory
Cobalt	5	1 L	Biased low
Copper	5	1 VL	Biased low
		3 L	
Iron	5	5 VL	Biased low
Manganese	5	4 VL	Biased low
Nickel	5	1 VL	Biased low
Lead	5	3 L	Biased low
Vanadium	5	5 VL	Biased low
Zinc	5	1 VL	–
		2 L	

Table D-11. Lab 13 (ICP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	1 H	Biased high
		4 VH	
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	1 H	–
		1 VH	
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-12. Lab 15 (AA and graphite, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	–
Cadmium	0		
Cobalt	0		
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	3 VL	Biased low
		1 L	
Lead	0		
Vanadium	5	4 VH	Biased high
Zinc	0	2 H	Biased high

Table D-13. Lab 19 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	2 H	–
Cobalt	5	0	Satisfactory
Copper	5	1 VH	–
Iron	5	1 H	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	1 L	Satisfactory
Lead	0		
Vanadium	5	1 H 3 VH	Biased high
Zinc	5	3 L	Biased low

Table D-14. Lab 19B (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5 (5 less than)		Insufficient data
Cobalt	5	0	Satisfactory
Copper	5	1 L 1 VH	–
Iron	5	2 H	Biased high
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	1 H 2 VH	–
Vanadium	5	2 H 3 VH	–
Zinc	5	0	Satisfactory

Table D-15. Lab 19C (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	1 VL 1 VH	–
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	0		
Vanadium	5	1 H 1 VH	–
Zinc	5	0	Satisfactory

Table D-16. Lab 19D (ICP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	1 H	Satisfactory
Cadmium	5 (5 less than)		Insufficient data
Cobalt	5	0	Satisfactory
Copper	5	3 L	–
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	1 H	Satisfactory
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-17. Lab 21 (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	0	Satisfactory
Cobalt	0		
Copper	5	0	Satisfactory
Iron	5	1 H	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-18. Lab 23 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	1 VL	–
Cadmium	5	1 VH	–
Cobalt	5	1 H 4 VH	–
Copper	5	1 VH	–
Iron	5	1 VL 1 VH	–
Manganese	5	1 VL	–
Nickel	5	2 H 1 VH	–
Lead	5	3 VL	Biased low
Vanadium	5	2 H 3 VH	Biased high
Zinc	5	2 VH	–

Table D-19. Lab 24 (AA and DCP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	1 VH	–
Cobalt	5	0	Satisfactory
Copper	5	2 H	–
Iron	5	1 H	Biased high
Manganese	0		
Nickel	5	2 H	–
		1 VH	
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-20. Lab 30 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	5	3 H	–
Zinc	5	0	Satisfactory

Table D-21. Lab 30B (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	2 H	Biased high
Cadmium	5	3 L	–
Cobalt	5	0	Satisfactory
Copper	5	1 H	Biased high
		4 VH	
Iron	5	0	Satisfactory
Manganese	5	1 L	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-22. Lab 30C (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	1 H	Satisfactory
Manganese	5	2 H	–
		2 VH	
Nickel	5	1 H	Satisfactory
Lead	5	0	Satisfactory
Vanadium	5	2 H	Biased high
		2 VH	
Zinc	5	1 H	–
		1 VH	

Table D-23. Lab 30D (ICP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	2 H	Biased high
Manganese	5	1 H	Satisfactory
Nickel	5	1 H	Satisfactory
Lead	5	0	Satisfactory
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-24. Lab 34 (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	2 H	Biased high
		3 VH	
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	4 H	–
Nickel	5	1 H	Satisfactory
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	1 H	Satisfactory

Table D-25. Lab 41 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium (graphite)	5	2 VL	–
Cobalt	0		
Copper	5	2 VL	–
Iron	5	0	Satisfactory
Manganese	0		
Nickel	5	1 H	–
		3 VH	
Lead (graphite)	5	1 VL	–
		4 VH	
Vanadium	0		
Zinc	5	1 VH	–

Table D-26. Lab 47 (DCP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	5 VH	Biased high
Cobalt	5	0	Satisfactory
Copper	5	1 L	–
		1 H	
Iron	5	1 VH	–
Manganese	0		
Nickel	5	1 H	Satisfactory
Lead	5	2 H	Biased high
		3 VH	
Vanadium	0		
Zinc	5	1 H	–
		1 VH	

Table D-27. Lab 51 (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	Biased low
Cadmium (AAS)	5	1 L	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	1 VL	–
		2 L	
Manganese	5	1 L	Satisfactory
Nickel	5	0	Satisfactory
Lead (AAS)	5	0	Satisfactory
Vanadium	5	5 VL	Biased low
Zinc	5	0	Satisfactory

Table D-28. Lab 53 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	Biased low
Cadmium (graphite)	5	0	Satisfactory
Cobalt	5	5 VH	Biased high
Copper	5	5 VL	Biased low
Iron	5	2 L	–
Manganese	5	0	Satisfactory
Nickel	5	1 VL	Biased low
		1 L	
Lead	5	2 L	–
Vanadium	5	1 VH	–
Zinc	5	0	Satisfactory

Table D-29. Lab 57 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	0		
Manganese	5	2 VL	–
		1 L	
Nickel	5	0	Satisfactory
Lead	5	1 L	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-30. Lab 57B (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium (ICP/MS)	5	0	Satisfactory
Cobalt	5	1 L	Satisfactory
Copper	5	1 L	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	1 VL	–
		1 L	
Nickel	5	1 H	Satisfactory
Lead (ICP/MS)	5	1 L	Satisfactory
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-31. Lab 58 (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Biased high (slightly)
Manganese	5	0	Satisfactory
Nickel	0		
Lead	5	1 H 2 VH	–
Vanadium	5	0	Satisfactory
Zinc	5	1 H	Satisfactory

Table D-32. Lab 58B (ICP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	Biased low
Cadmium	5	0	Satisfactory
Cobalt	5	2 VL 3 L	Biased low
Copper	5	5 VL	Biased low
Iron	5	5 VL	Biased low
Manganese	5	4 VL 1 L	Biased low
Nickel	5	5 VL	Biased low
Lead	5	5 VL	Biased low
Vanadium	5	5 VL	Biased low
Zinc	5	2 VL	–

Table D-33. Lab 58C (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	0		
Cobalt	0		
Copper	0		
Iron	0		
Manganese	0		
Nickel	5	0	Satisfactory
Lead	0		
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-34. Lab 60 (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5 (3 less than)		Insufficient data
Cobalt	5	1 L	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	0		
Nickel	5	0	Satisfactory
Lead (AAS)	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-35. Lab 62 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	1 H	Satisfactory
Cadmium	5	1 L 1 VH	–
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	1 H	Satisfactory
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-36. Lab 65 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	2 VL 1 L	–
Cadmium	5	4 VH	–
Cobalt	5	1 H 4 VH	Biased high
Copper	5	1 VL	–
Iron	5	3 VL 1 L	–
Manganese	5	0	Satisfactory
Nickel	5	3 VH	–
Lead	5	5 VH	Biased high
Vanadium	5	0	Satisfactory
Zinc	5	1 VL 1 L	Biased low

Table D-37. Lab 67 (ICP, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium (AAS)	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	2 L	–
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-38. Lab 71 (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	0	Slight bias low
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	2 VL 3 L	–
Manganese	5	4 VL	Biased low
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	1 VL	–

Table D-39. Lab 73 (AA and graphite, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	–
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	1 L	Satisfactory
Manganese	5	1 L	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	5	1 VL	–
Zinc	5	0	Satisfactory

Table D-40. Lab 74 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	1 H	Biased high
Cadmium	5	0	Satisfactory
Cobalt	5 (5 less than)		Insufficient data
Copper	5	1 H	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5 (4 less than)		Insufficient data
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	1 H	Satisfactory

Table D-41. Lab 74B (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	0	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	3 L	Biased low
Iron	5	2 L	–
Manganese	5	1 VL 2 L	–
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-42. Lab 76 (INAA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	0		
Cobalt	5	0	Satisfactory
Copper	0		
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5 (3 less than)		Insufficient data
Lead	0		
Vanadium	5	1 VL	–
Zinc	0		

Table D-43. Lab 89 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	1 H	–
		1 VH	
Cobalt	5	1 H	Satisfactory
Copper	5	1 H	Satisfactory
Iron	5	1 VL	–
		1 L	
Manganese	5	2 VL	–
		1 L	
Nickel	5	0	Satisfactory
Lead	5	1 VH	–
Vanadium	0		
Zinc	5	1 VH	–

Table D-44. Lab 93 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	1 L	Satisfactory
Cobalt	0		
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	1 VL	–
		1 L	
Nickel	0		
Lead	5	1 H	–
		2 VH	
Vanadium	0		
Zinc	5	2 L	Biased low

Table D-45. Lab 93B (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	0		
Cadmium	5	2 H	–
Cobalt	0		
Copper	5	4 VL	Biased low
		1 L	
Iron	5	5 VL	Biased low
Manganese	5	3 VL	–
		1 L	
Nickel	0		
Lead	5	1 VL	–
Vanadium	0		
Zinc	5	2 VL	Biased low
		2 L	

Table D-46. Lab 102 (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	1 L	Satisfactory
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron (Fusion, Titration)	5	0	Satisfactory
Manganese	5	2 H	–
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-47. Lab 109 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	0		
Cobalt	5	0	Satisfactory
Copper	5	2 L	–
Iron (Fusion, Titration)	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-48. Lab 109B (AA, T, + $HClO_4$ acid)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	0		
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	2 H	–
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-49. Lab 111 (AA, T, 0.25 g + boric acid)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	3 H	–
		2 VH	
Cobalt	5	2 H	–
		2 VH	
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	1 H	–
		3 VH	
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-50. Lab 111B (AA, T, 0.1 g - boric acid)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5	3 VH	–
Cobalt	5	5 VH	Biased high
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	1 H	–
		1 VH	
Nickel	5	4 VH	Biased high
Lead	5	5 VH	Biased high
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-51. Lab 119 (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VH	Biased high
Cadmium	5	0	Satisfactory
Cobalt	5	1 H	Satisfactory
Copper	5	1 VH	–
Iron	5	2 H	–
Manganese	5	1 L	Satisfactory
Nickel	5	3 H	Biased high
Lead	5	1 H	Biased high
		4 VH	
Vanadium	5	2 H	Biased high
		1 VH	
Zinc	5	5 VH	Biased high

Table D-52. Lab 120 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	1 VL	–
Cadmium	5	1 L	Satisfactory
Cobalt	5	2 L	–
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	2 H	–
		1 VH	
Nickel	5	0	Satisfactory
Lead	5	1 L	Satisfactory
Vanadium	5	0	Satisfactory
Zinc	5	1 H	Satisfactory

Table D-53. Lab 120B (ICP, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	5 VL	–
Cadmium	5	3 L	Biased low
Cobalt	5	2 L	Biased low
Copper	5	0	Satisfactory
Iron	5	1 L	Satisfactory
Manganese	5	1 VL	–
		2 L	
Nickel	5	0	Satisfactory
Lead	5	0	Satisfactory
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Table D-54. Lab 130 (AA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5 (5 less than)		Insufficient data
Cobalt	5 (5 less than)		Insufficient data
Copper	5	0	Satisfactory
Iron	5	0	Satisfactory
Manganese	5	0	Satisfactory
Nickel	5	1 H	–
		2 VH	
Lead	5	0	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-55. Lab 130B (INAA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	0		
Cobalt	5 (5 less than)		Insufficient data
Copper	0		
Iron	0		
Manganese	5	0	Satisfactory
Nickel	0		
Lead	0		
Vanadium	5	0	Satisfactory
Zinc	0		

Table D-56. Lab 130C (AA, E)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	5 (5 less than)		Insufficient data
Cobalt	5	0	Satisfactory
Copper	5	0	Satisfactory
Iron	5	1 H	Satisfactory
Manganese	5	2 H 2 VH	Biased high
Nickel	5	2 H	Biased high
Lead	5	1 H	Satisfactory
Vanadium	0		
Zinc	5	0	Satisfactory

Table D-57. Lab 136 (INAA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	0		
Cobalt	5	0	Satisfactory
Copper	5 (4 less than)		Insufficient data
Iron	5	0	Satisfactory
Manganese	5	3 H 1 VH	Biased high
Nickel	5 (4 less than)	1 VH	Insufficient data
Lead	0		
Vanadium	5	0	Satisfactory
Zinc	5	3 H 2 VH	Biased high

Table D-58. Lab 137 (INAA, T)

Metal	No. of results reported	No. and type of flags	Appraisal
Aluminum	5	0	Satisfactory
Cadmium	0		
Cobalt	5	0	Satisfactory
Copper	0		
Iron	5	0	Satisfactory
Manganese	5	2 H	Biased high
Nickel	5 (4 less than)	1 VL	Insufficient data
Lead	0		
Vanadium	5	0	Satisfactory
Zinc	5	0	Satisfactory

Appendix E
List of Participants

APPENDIX E

LIST OF PARTICIPANTS

Agriculture Canada

Canadian Forestry Service, Chemical & Physical Analysis Laboratory, St. John's, Newfoundland

Environment Canada

Environmental Conservation Service
- Atlantic Region, Water Quality Branch Laboratory, Moncton, New Brunswick
- National Water Quality Laboratory, Water Quality Branch, Burlington, Ontario

Environmental Protection Service
- Atlantic Region, Chemistry Laboratory, Dartmouth, Nova Scotia
- EPS Newfoundland, St. John's, Newfoundland
- Northern Forest Research Centre, Edmonton, Alberta
- Pacific Region, Laboratory Services, West Vancouver, British Columbia
- Scientific Programs Branch, Analytical Services Lab, Edmonton, Alberta
- SPE Laboratoire, Longueuil, Québec
- Wastewater Technology Centre, Laboratory Services Section, Burlington, Ontario

Canadian Forestry Service
- Great Lakes Forest Research Centre, Sault Ste. Marie, Ontario
- Laurentian Forest Research Centre, Ste-Foy, Québec

Provincial Government Laboratories

B.C. Ministry of the Environment, Environmental Laboratory, Vancouver, British Columbia

Manitoba Department of Environment, Technical Services Laboratory, Winnipeg, Manitoba

New Brunswick Department of Environment, Municipal Affairs and Environmental Laboratory, Fredericton, New Brunswick

Ontario Ministry of Agriculture and Food, Agricultural Labs Services Branch, Guelph, Ontario

Ontario Ministry of Environment, Inorganic Trace Contaminants Section, Rexdale, Ontario

Ontario Ministry of Environment, Thunder Bay Laboratory, Thunder Bay, Ontario

Ontario Ministry of Northern Development and Mines, Ontario Geological Survey, Geoscience Laboratories, Toronto, Ontario

Québec Ministère de l'environnement, Section assurance de la qualité, Ste-Foy, Québec

Municipal Laboratories

City of Winnipeg, Laboratory Services Division, Winnipeg, Manitoba

Greater Vancouver Regional District, Main Laboratory, Burnaby, British Columbia

Industrial and Consulting Laboratories

Atlantic Analytical Services Ltd., St. John, New Brunswick

Barringer Magenta Ltd., Rexdale, Ontario

Beak Consultants Ltd., Mississauga, Ontario

Bondar Clegg & Co. Ltd., Ottawa, Ontario

Brenda Mines Ltd., Peachland, British Columbia

Chemex Labs Alberta (1984) Ltd., Calgary, Alberta

Chemex Labs Ltd., North Vancouver, British Columbia

Chemical and Geological Labs Ltd., Edmonton, Alberta

Cominco Ltd., Exploration Research Laboratories, Vancouver, British Columbia

Cominco Ltd., Analytical Services, Trail, British Columbia

École Polytechnique, Campus de l'université de Montréal, Montréal, Québec

Eco-recherches (Canada) Inc., Pointe-Claire, Québec

Enviroclean Ltd., London, Ontario

Enviro-Test Labs, Edmonton, Alberta

Monenco Analytical Laboratories, Calgary, Alberta

Noranda Mines Ltd., Noranda, Québec

Nuclear Activation Services Ltd., Hamilton, Ontario

Ontario Hydro, Etobicoke, Ontario

Shell Canada Ltd., Calgary Research Centre, Calgary, Alberta

University Laboratories

University of Alberta, Slowpoke Reactor Facility, Edmonton, Alberta